The Electrical Industry's Weekly Magazine

July 15, 1957

Electrical World

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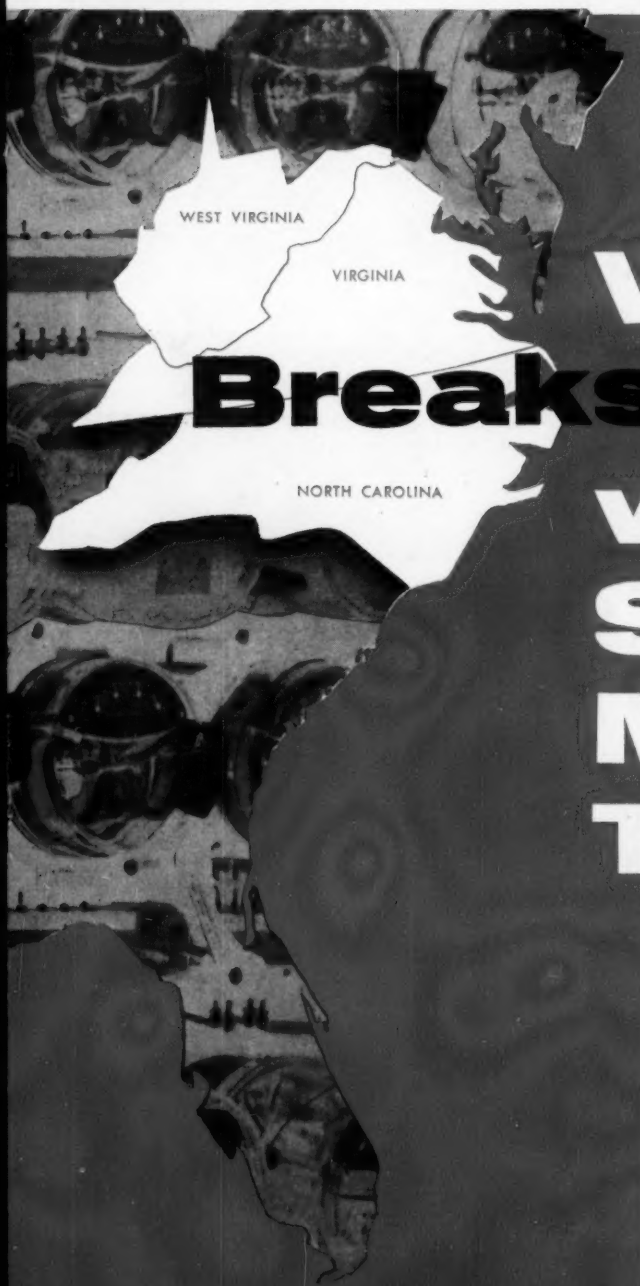

Vepco Breaks Through with Selective Meter Testing

...Page 72

AIEE at Montreal: System Growth . . . . . Page 66

E B POWER
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH

BLAST OF INSULATING GAS blows out arc in enclosed fuse cutout. New G-E gas load-break device provides quick, economical load switching and line sectionalizing at currents up to the cutout's full load current rating.

Utility load-switching practices improved through research at G-E Short-circuit Lab

NEW LOAD-BREAK DEVICE is shown being tested by cutout design engineers R. E. Koch (left) and E. A. Vrabel at General Electric Short-circuit Laboratory where device was developed. This gas load-break feature is now available on all new General Electric 100 ampere enclosed fuse cutouts.

New use of insulating gas provides automatic, quick load-break device

Rapidly growing loads and increasing system complexity continually pose difficult problems for electric utilities. General Electric's Short-circuit Laboratory, Pittsfield, Mass., has long been an important tool in researching solutions to these problems.

A recent example of such research is the fulfillment of a need often expressed by utilities—the need for a low-cost device, preferably an integral part of an enclosed fuse cutout, that would effectively break load up to the cutout's full load current rating. Gas load break is General Electric's answer to this problem.

This load-break device was made possible by a new application of insulating gas. A small non-corrosive metal cylinder containing gas under pressure is used to extinguish the arc that develops when the cutout is opened under load. As the cutout is opened, the arc melts the cylinder's non-corrosive tip. The escaping gas quickly blows out the arc without damage to the fuse.

With this device it is now possible to isolate a transformer or branch circuit without operating the main breaker. Therefore, interruption of service to customers and the accompanying opportunity for customer dissatisfaction is reduced.

For more information on how this device can help simplify and improve your load-switching practices, contact your General Electric Apparatus Sales Office, or write for bulletin GEA-6208 to General Electric Company, Section 301-353, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 148, No. 3 July 15, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Features

CURRENT EVENTS

Utilities Snap Back After Hurricane

Winds take down 65 miles of line in one stretch. Two lose lives in utility restoration efforts.....p 58

"More Power at Lower Cost"

That was theme of 14th annual APPA convention. Delegates back use of revenue bonds for federal projects.....p 63

MEETING REPORT

AIEE Summer General Meeting

Electrical World editors give lengthy report on papers of significance to electric utility industry.....p 66

METERING

Sampling Technique Cuts Testing Cost

Vepco, with okays from three state commissions, replaces periodic meter tests with selective program.....p 72

SYSTEM ENGINEERING

Trends and Practices in System Planning

Report of EEI subcommittee summarizes system planning practices of 46 electric companies in 1955.....p 75

Departments

Atomic Progress 61
Books 121
Catalogs and Bulletins.....118
Editorials 57
• Electrical Newsletter 19
Engineering Reference Sheet... 90
From the Publisher..... 5
How To 83
• Management Newsletter 135
Manufacturers and Markets.....124
Meetings Calendar 130
New Equipment 106
News About People.....140
News-Beat 62
Readers Forum 148
Selling 94
Technical Literature 120
Washington Wire 59

INDEX TO ADVERTISERS.....153

Okolite-Okoprene aerial cables furnish a low-cost route for increased power demands over a span of 420 feet between buildings.

More power the low cost way ...with Okolite-Okoprene aerial cable

To meet the power demands of increased cigarette production, The R. J. Reynolds Tobacco Company of Winston-Salem, North Carolina, recently installed the two Okolite-Okoprene aerial cables shown here. An operating voltage of 15kv and a span of 420 feet across two open primary lines and railroad sidings called for aerial cables with maximum reliability. Okolite-Okoprene self-supporting cable was used, with extra messenger for added safety.

Here is another case where an Okonite self-supporting aerial cable solved an increased power-demand problem simply and economically. The overhead route often costs much less than the underground route . . . and it can be just as safe, too, when you use dependable Okolite-Okoprene cable. Recommended for general use up to 35kv, Okolite-Okoprene is insulated by Okonite's exclusive strip process and (if rated at over 2kv) inspected inch-by-inch on the Gooding Test Train.

Okonite is the only manufacturer making cables by all insulating methods: strip, extrusion, tape or dip. Thus we are in the unique position of being able to recommend to you without prejudice the one cable which most closely meets your requirements. The Okonite Company, Passaic, New Jersey.

where there's electrical power . . . there's **OKONITE CABLE**

4899

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. . . *from the publisher*

Think back a year ago, Nasser didn't have the Suez Canal. The Bull Market had yet to find its ceiling. "Tight money" was more a phrase than a fact.

As the song goes, "there've been some changes." Where the economy of 12 months ago was called a "boom on top of a boom," today's is one of "rolling readjustment."

Tight money, lagging appliance sales, the decline in housing starts, and a leveling off in industrial production touch the electric utilities as well as the rest of the economy. And it becomes more imperative than ever that we take another hard look at the near and long-term prospect for the electric utility industry.

That's why right now we're in the process of putting together our 8th Annual Electrical Industry Forecast. As in former years, the foundation of our forecast will be the latest, up-to-date scrutiny of the economy in general as seen through the eyes of McGraw-Hill's department of economics.

With so many undercurrents active in business, this annual soul-searching is a prime necessity. Slated for publication Sept. 2, this year's forecast is shaping up with some definite changes over the industry's prognostications we made 12 months ago (Sept. 17, 1956, p 149). On Sept. 2, it will be your hands—the best one that the combined resources of the industry and its weekly magazine know how to produce.

Fischer Black

ELECTRICAL WORLD

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Thirteen Electric Utilities Buy New General Electric Automatic Dispatching System

Completely automatic control provides answer to problems caused by rapid extension of interconnections and the trend to pool operation.

Successful operation of the new General Electric automatic dispatching system has resulted in rapid acceptance by many utilities of this unique system to help solve the problem of generating power at the lowest possible cost.

Introduced recently, the G-E system has already been ordered by 13 power companies.

If you are concerned with the problems of meeting the rapidly increasing demand for electric energy, of maintaining interchange power schedules and frequency, and of operating most economically, why not investigate the first completely automatic dispatching system.

Here are some of the major reasons why 13 utilities have already ordered General Electric automatic dispatching systems:

1. Most economical schedule is automatically computed and executed based on loading at incremental cost of delivered power.

TYPICAL INSTALLATION of General Electric automatic dispatching system equipment includes this dispatcher's office console.

2. Only one control channel is needed for each generating station and no recorders are required as an integral part of the General Electric system.

3. Low installation expense because the control equipment is factory assembled and tested in "package" consoles requiring few customer connections.

4. Continuous control makes cost information always available to provide economic operation and correct "buy" or "sell" decisions.

5. Dispatcher need not calculate detailed daily loading schedules nor does the addition or removal of machines require any readjustment of control equipment.

6. Transmission-loss penalty factors are determined and applied manually or automatically.

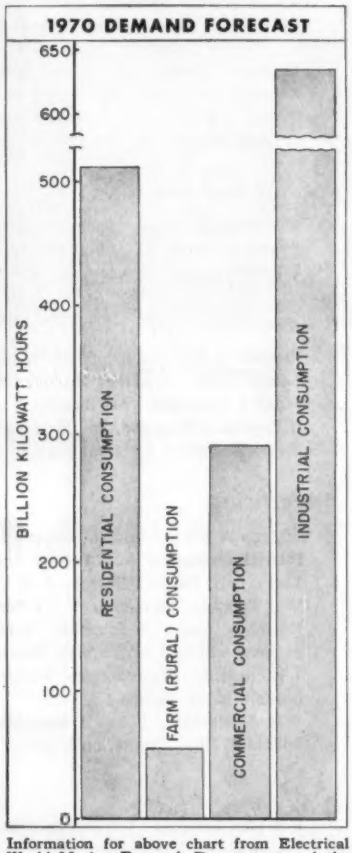
7. Continuous and synchronized control is provided by the use of a highly accurate selsyn system installed on generator governors.

8. An individual installation can be conveniently expanded to bring more generation under control or to increase the functions of the existing control.

9. The control system is readily adaptable to pool operation in the interconnection of utilities.

10. The General Electric ADS equipment is compatible with other control equipment already installed.

Complete information may be obtained by contacting your nearest General Electric Apparatus Sales Office, or by writing to Section 585-59, General Electric Company, Schenectady 5, New York.

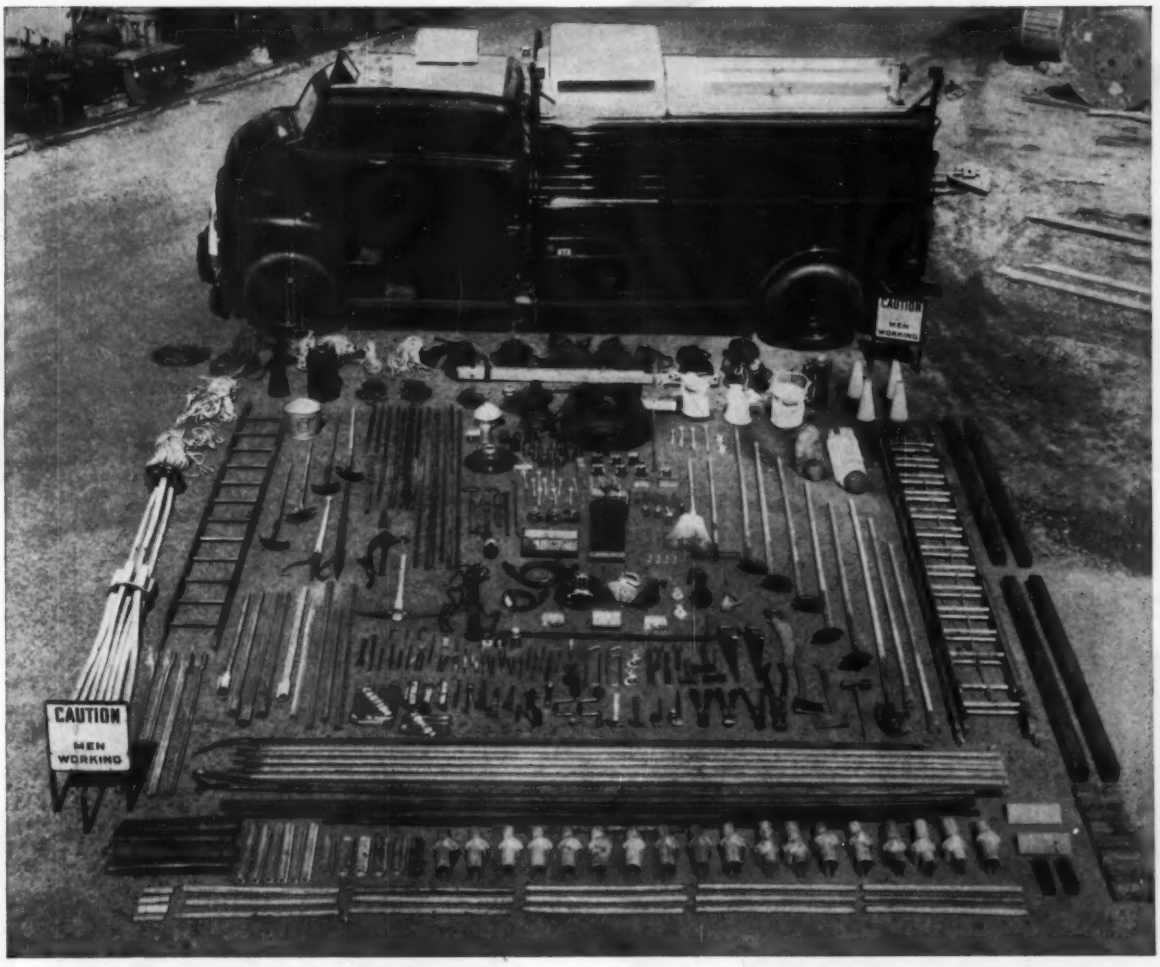


Information for above chart from Electrical World Market Research Department and the McGraw-Hill Department of Economics.

RAPID GROWTH of power demand will multiply your dispatching problems. G.E.'s automatic dispatching system is uniquely designed to improve your present operation and help you prepare for the future.

Progress Is Our Most Important Product

GENERAL ELECTRIC



Look at your line truck equipment needs from this angle . . .

Here's a poles-eye view of a typical utility line truck showing the wide variety of construction and maintenance tools and safety equipment your linesmen need for most day-to-day jobs. But—without exception—each and every item shown can be ordered conveniently from your nearby Graybar office or warehouse . . . and in every case you get the type and quality needed to assure speed and efficiency on the job *plus* long years of satisfactory service. All are products your linesmen know and respect—products that have been tried, tested and proven in the field by scores of companies just like your own.

Remember, when you order "via Graybar", you save the time and expense of multiple inquiries, for you can select, from this single source, the items best suited to your needs from among the products of over 200 of the nation's leading manufacturers.

Graybar is thoroughly familiar with utility requirements. Further, your nearby Graybar Representative stands ready to help as a convenient source of information on everything needed for pole-line construction and maintenance. And should you be faced with an out-of-the-ordinary problem, call on the experience of a Graybar Outside Construction Specialist for a consultation. We'll welcome your inquiry!

511-97

CALL GRAYBAR FIRST FOR . . .

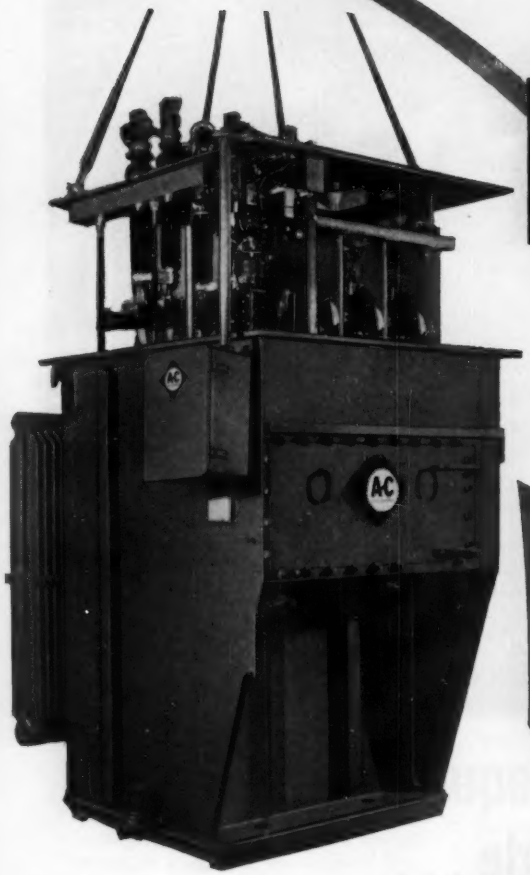
GraybaR Everything Electrical

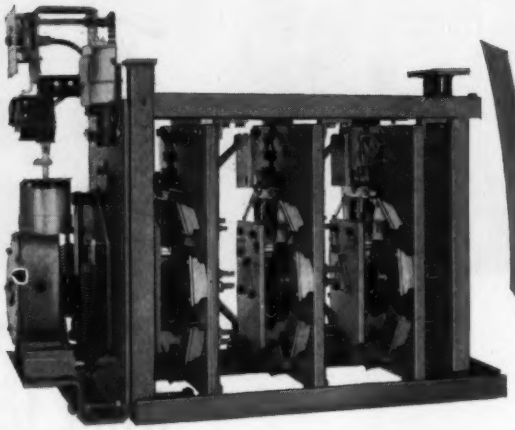
GraybaR ELECTRIC CO., INC.
420 Lexington Ave., New York 17, N. Y.

IN OVER 130 PRINCIPAL CITIES

reasons for service

Allis-Chalmers





unit construction

— makes untanking easy . . . assures good workmanship.

In this construction, transformer and tap-changing mechanism are mounted to cover. All connections are made while unit is accessible, before it is tanked. Continuous leads from transformer coils to dial switch add reliability by eliminating 78 electrical connections.

simple mechanism

Many gears and cams are eliminated to reduce moving parts to a minimum. Simple, condenser-type motor has no commutator, slip rings, brushes or centrifugal switch. Driving motor and moving parts never require lubrication or adjustment because they are completely immersed in oil. Taps changed with fast snap action — without shock — without brakes or sealing-in switches.

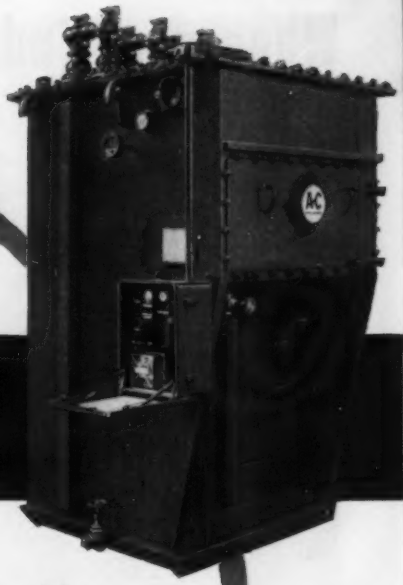
These are only a few of the many outstanding features that account for the remarkable record of A-C 3-phase regulators. For complete specifications, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

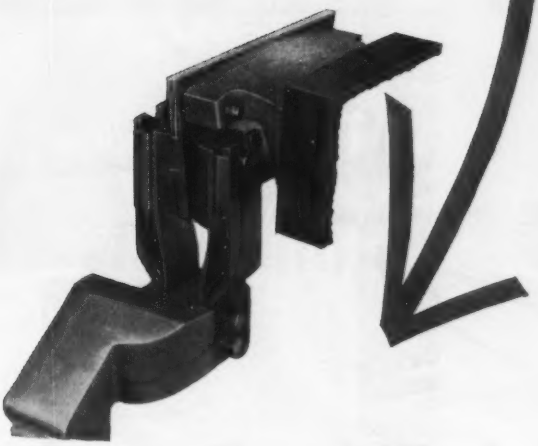
A-C ALLIS-CHALMERS

A-5472

remarkable of

3-phase regulators





longest contact life

Sturdy double-contact construction with backing springs assures high contact pressure. This arrangement prolongs life of contacts by minimizing blowback from severe short circuits . . . reducing contact bounce . . . cutting arcing time. Large contacts, which increase thermal capacity, are made of sintered RS-1045 for high resistance to pitting and burning.

"feather-touch" control

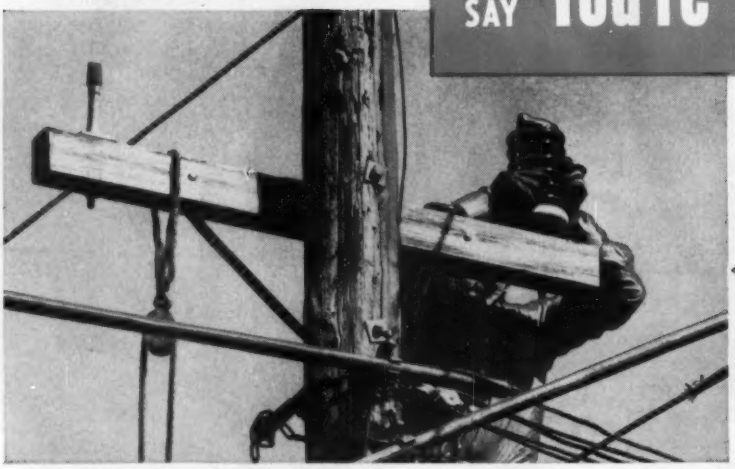
Fully automatic control, with sensitive response to voltage deviation, keeps voltage within band settings. Simple design makes all parts accessible for easy inspection and adjustment. Electrically interlocked motor switches permit only one circuit to close at a time. Stabilizing coil incorporated into solenoid of voltage-regulating relay.

ALLIS-CHALMERS

When good judgment leads to different selections

"I like pintypes"

WE SAY **You're Both Right...**



"I like line posts"

and O-B Will Supply Either Type

One customer says, "I like O-B pintypes. We've used them for years without mechanical or electrical failures. Porcelain is the only insulating medium and we know it's dependable. Wide-spaced shells break up the flow of drip water. Flanges aren't shorted out, so wet flashover values stay reasonably high."

Another customer says, "I prefer O-B line posts. We like their looks. We like their performance. They have high leakage resistance. The exposed surfaces are easily washed by rain. There's no sheltered area on the crossarm."

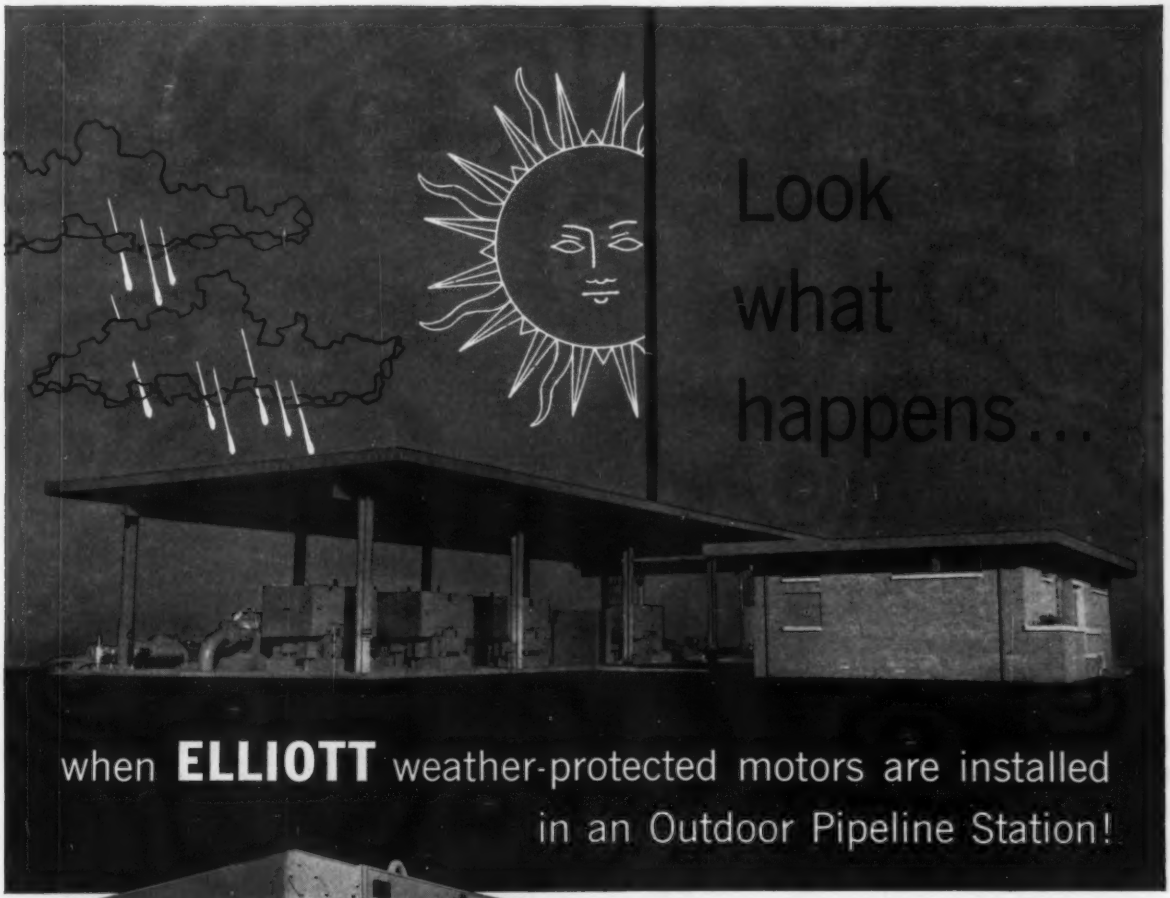
Are these two points of view contradictory? We don't think so. We make both types. If we had to make a choice between the two, it would be hard to do. Personal opinion and local conditions would undoubtedly weigh heavily.

It's up to you to make the choice. We offer the best designs of pintypes or line posts. Don't take our word for this, your own records undoubtedly tell the same story. In other words, be sure to specify O-B whether your preference be pintype or line post.

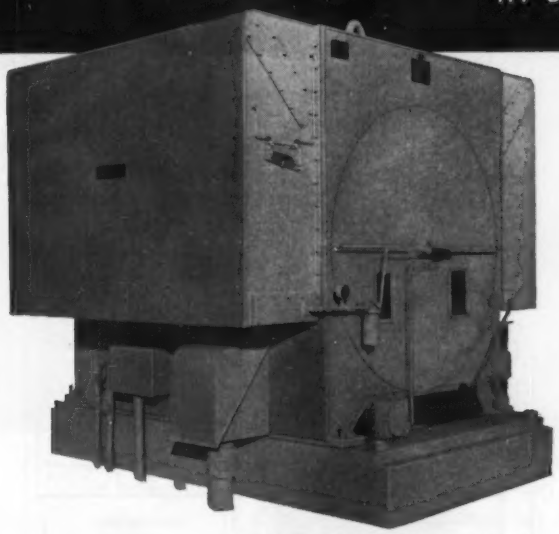
OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

4759-H



when **ELLIOTT** weather-protected motors are installed in an Outdoor Pipeline Station!



This Elliott 1250-hp, 2-pole, squirrel-cage induction motor, originally round frame as below, is one of the three motors which was rebuilt for year 'round weather protection. All four Elliott motors at the Laura Station are direct-connected to the oil pumps.

One of the three Elliott round-frame motors as it appeared originally.

Costs Are Slashed. The outdoor structure costs far less and maintenance as well as year 'round operating costs are reduced. Besides that, Elliott motors are especially designed for safe, dependable, trouble-free operation *in all kinds of weather.*

Take the case of the Service Pipeline Company in Illinois. Rebuilding the above Laura Station as an outdoor facility, this company installed four Elliott weather-protected squirrel-cage induction motors. The station includes a canopy which gives extra protection from rain and sun—added insurance against the possibility of direct sunlight tripping the thermal devices, and provides a chain hoist for maintenance. Both the concrete slab area and the canopy extend far enough to provide ample working space around pumping units.

Three of the four motors, originally dripproof round-frame, were rebuilt to weather-protected designs—resulting in additional savings. Windings were given added treatment by immersing coil ends and baking. Explosion-proof bearing temperature and oil pressure relays were provided to assure maximum safety for operation in a hazardous atmosphere. These and other features of the Elliott weather-protected motors permit the erection of simplified outdoor stations instead of more costly enclosed housings. For further details, call your nearby Elliott District Office or write . . .

ELLIOTT Company

Ridgway Division • Ridgway, Pa.

R7-1

Now Under Construction...

18% MORE POWER

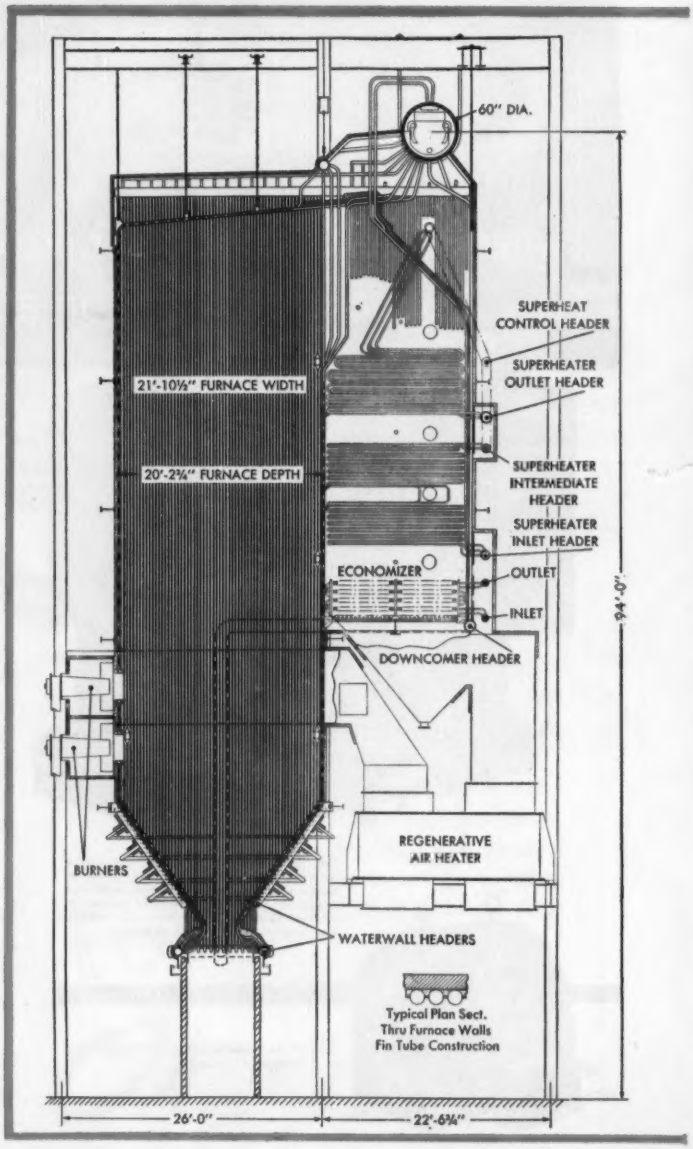
New 88,000-kw Yarmouth Station will be served by

TWO FW STEAM GENERATORS

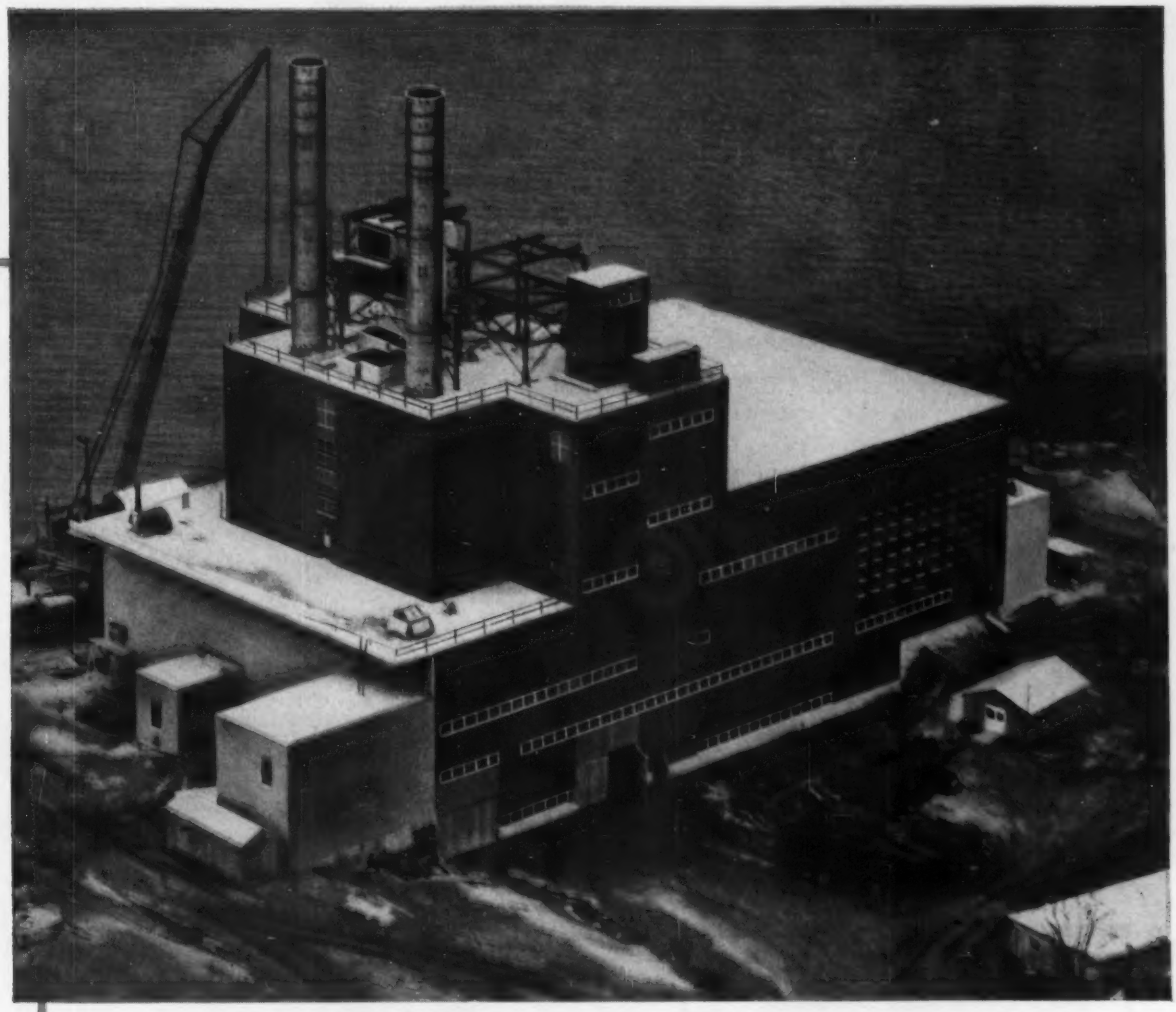
To meet Maine's growing demand for electric power, the Central Maine Power Company is building a new station at Yarmouth which increases total system capacity from 470,730 to 558,730 kw. This installation will consist of two identical units, each with a rated capacity of 44,000 and capability of 50,000 kilowatts.

Foster Wheeler is supplying the two steam generators for this important new station. Each will produce 490,000 pounds of steam per hour at 1575 psig design pressure, 950 F, and will deliver steam to the turbines at 1250 psig. These units are designed for either oil or coal firing.

With more than fifty years of experience in steam generation—and the finest modern manufacturing facilities in three large plants — Foster Wheeler welcomes the opportunity to quote on your requirements. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*



for CENTRAL MAINE



An aerial view of the new Yarmouth Station of Central Maine Power Company. Unit No. 1 is scheduled to be in operation this year and Unit No. 2, in 1958. During the past decade, virtually every kind of Maine business has drastically increased its kilowatt-hour use of electric power. The Yarmouth Station will keep CMP well ahead of this growing demand — immediately increasing total system capacity by 18%.

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

501 Kva Cluster-Mounted on One Pole..

Detroit Edison does it with 3 167-kva Featherweight POLE STARS

Here you see how Detroit Edison Company solved the problem of serving a small manufacturing plant without going to the trouble and expense of installing either a second pole and platform, or a vault.

Cluster-mounting of Featherweight Pole Star 167's can be an effective, economical way to provide power for shopping centers . . . . or to increase service to newly expanded commercial sections. Introduced by Pennsylvania in 1953, Featherweight Pole Stars "pioneered" the extension of pole mounting to 167-kva transformers. They have proved easy to handle, easy to install under all conditions . . . and linemen like the "slim" Pole Star design that encroaches so little on the climbing area.

Featherweight Pole Star 167's are available for pole mounting in every standard distribution voltage through 16,340 volts. Like all other members of the Pole Star line, they offer the long-range advantages of Pennsylvania's patented "lap-on-top"core.

Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pa.

Why Utility Engineers asked for this POLE STAR *transformer*

- ★ Will replace any single phase 75- or 100-kva pole-mounted transformer to provide 67% to 123% more capacity
- ★ Weighs less than 1500 pounds
- ★ Lower in overall height than average 100-kva transformer
- ★ Available in standard voltages up through 16,340 volts

Mechanical Characteristics

Weighs approximately 1500 pounds.
Conforms to EEI-NEMA Sixth Report.
Overall floor space slightly larger than average for 100-kva transformers.
Overall height approximately 8" less than industry average for 100-kva transformers.

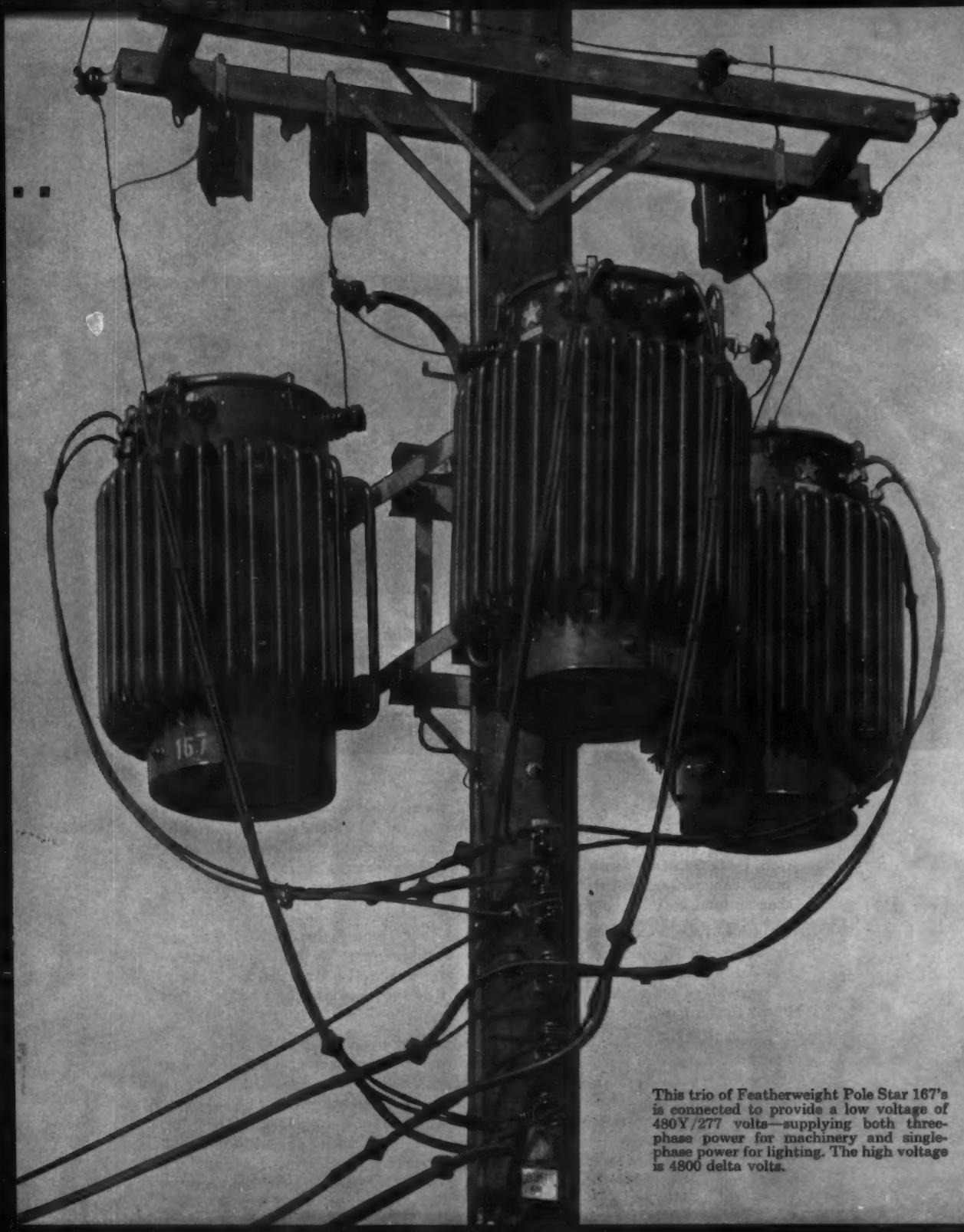
Electrical Characteristics

Patented "lap-on-top" Pole Star core, combined with effective coil design, results in low losses, low impedance, and good regulation.
Low exciting current found in all Pole Star designs also is inherent in the 167-kva Featherweight Pole Star.

McGRAW EDISON

PENNSYLVANIA TRANSFORMERS pt

PENNSYLVANIA



This trio of Featherweight Pole Star 167's is connected to provide a low voltage of 480Y/277 volts—supplying both three-phase power for machinery and single-phase power for lighting. The high voltage is 4800 delta volts.

DISTRIBUTION TRANSFORMERS

CONDENSER-TYPE • To save equipment size and weight . . . to facilitate interchangeability for replacement in older equipment . . . ASA Standards call for bushings of small diameter. This requirement is met, with wide safety factors in operation, by Lapp POC* Bushings. The internal voltage stresses resulting from these small diameters are distributed by a series of equal-capacitance condensers equally sharing total bushing voltage.

PAPER-OIL INSULATION • For its high dielectric strength, low dielectric loss and proved dependability in service, Kraft paper oil-impregnated is preferred as insulation for highest-voltage applications. That's why paper-oil is used in your highest-voltage cables, potheads and bushings—**and** why the condenser core of the Lapp POC* Bushing is paper-oil insulated.

ENCLOSED CORE • The housing which encloses the condenser core of the Lapp POC* Bushing is an assembly of metal and porcelain, permanently sealed against temperature change, cantilever or impact stresses. Leakage currents—which can and do result from moisture and contamination in transformer and circuit breaker oil—can flow only over the porcelain shank of the POC* Bushing. This is positive protection to the bushing core, since there's no charring, tracking or deterioration of porcelain from such leakage current. Storage problems of spare bushings are simplified, too, because the porcelain shank of the POC* Bushing needs no protection from natural elements.

Lapp POC* is the bushing design of the future. It's proved and ready to serve you reliably today.

WRITE for specification data. Lapp Insulator Co., Inc., Le Roy, New York.

Lapp

POC* BUSHING

*PAPER-OIL CONDENSER TYPE
TOTALLY-ENCLOSED CORE
ASA STANDARD

Now for "Preferred-Emergency" Switching

an Off-the-Shelf

AUTOMATIC TRANSFER PANEL

With *Any Desired* Throwover Scheme ...at the *Flip of a Switch!*

A Flip of the Switch Gives You:

- Choice of making either source preferred.
- Choice of automatic or manual (semi-automatic) return.
- Adjustable time delays —range up to 10 minutes.
- Optional manual operation of line switches.
- Choice of returning: in either open or closed transition (with or without paralleling).
- Optional lockout on bus faults.

Other Unique Features:

- Indicating lamps for switch positions, live sources, and lockout action.
- Alarm to prevent leaving panel set on "manual operation."
- Transparent cover over selector switches prevents unintended changes in settings.

Saves Time and Money

You don't have to design and build (or negotiate for) — your special automatic transfer panels in order to get the special specific throwover schemes you need. The new S&C Automatic Transfer Panel will give you any or all throwover options... selector switches give the scheme you want!

With this new stock panel you can eliminate the engineering and correspondence involved in getting custom-built panels.

Furthermore, you are sure of getting what you want today; tomorrow you can change your mind, and later you can revise the scheme—still using the same transfer panel. Imagine! You can order your panel ahead of time, before specifications are settled.

— Buy from our stock for your stock —

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

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POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

NEWS-SCOPE

FUTURE NEWS ▶ **Florida electric utilities are weighing decision** to abandon dependence on fuel oil and make switch to coal. High freight rates on coal have been main hitch. Decision could come at a meeting July 17 of the power companies, Southern coal and railroad interests.

Utility purchasing agents fully expect across-the-board price increases on electrical equipment before the end of the present wave of price hikes. As far as possible they have ordered ahead, but the "tight money" situation has put them in a squeeze.

Next year is sure to set records for generating additions, but they won't be as high as now planned. Realistic forecast is for gross capability additions of 16.5 million kw rather than the 17.4 million kw planned. With retirements, net capability gain will be around 15.6 million kw.

LATE NEWS ▶ **Equipment prices keep going up** . . . Westinghouse Electric's Transformer Division boosts prices 2.6% for voltage regulators and 4% for power, network, substation, and power center transformers, and reactors. Switchgear dept hikes prices 5% on all assembled switchgear and devices, and 7% on power fuses, outdoor circuit breakers, and compressed air breakers . . . At General Electric, the Transformer Division's 4% hike will affect electric furnaces, single-circuit and mobile substations, current-limiting reactors and grounding devices, voltage regulators, and high-voltage testing equipment . . . Allis-Chalmers' Power Equipment Division announces price increases for most electrical distribution and generating equipment. Increases average 3 to 4% with individual product adjustments varying from no change to 7%. (For other price changes, see p 135.)

Five-day unauthorized walkout ends at Florida Power & Light Co. Some 1,000 employees working in Dade and Broward counties participated over day suspension of one plant employee.

Wage boost of 5.1% offered by Ohio Edison is accepted by Utility Workers Union's 200 members, and rejected by negotiators for 760 members of International Brotherhood of Electrical Workers.

Rate increase affecting almost all classes of customers is planned by Commonwealth Edison and its Public Service Co Division.

Security offerings made by electric utilities last week: Leading the pack was a $15 million Central Illinois Light first mtg 4⅝% bonds (Aa rating) due 1987 which was won by a syndicate headed by First Boston Corp with a bid of 100.03%. They are being reoffered at 100.80% to yield 4.576% . . . an issue of $20 million West Penn Power first mtg 4⅞% bonds (Aa rating) due 1987 was won by a group headed by Halsey Stuart & Co, Inc, with a bid of 100.806%; these bonds were later being offered at 101.666% to yield 4.77%.

ELECTRICAL WEEK

A TWO-MINUTE

AIEE MEET ▶ **Technical sessions provided the real meat** of the summer general meeting of the American Institute of Electrical Engineers held in Montreal, June 24-28. Special report on the meeting in this issue highlights papers of particular interest to utility engineers. Some samples: Integration of five utility systems in Texas saves an estimated $4 million a year; Philadelphia Electric is building miniature dc transmission system to see "what makes dc transmit;" automatic switching from faulted to spare conductor is interesting aspect of control scheme for 132-kv submarine cable running from Vancouver Island to mainland in British Columbia. You'll find scores of recent technical developments crammed into the special 6-page report **(p 66).**

EVENTS ▶ **Louisiana utilities patch up systems ripped by Audrey,** first hurricane of the season. Gulf States Utilities suffers damages initially estimated at $300,000. Two utility workers lose lives **(p 58)** . . . American & Foreign Power believes its Latin American outlook has brightened in past five years **(p 60)** . . . American Public Power Association backs use of revenue bonds for federal power projects in TVA and Pacific NW areas **(p 63).**

ATOMIC PROGRESS ▶ **British (atomic energy) Insurance Committee finds that risks** associated with atomic power installations "are insurable." It recommends that all claims be against reactor owner **(p 61).**

WASHINGTON ▶ **Threatened civil rights filibuster in Senate** is almost certain to stall action on such bills as Niagara power development, atomic insurance, atomic power authorization, and TVA revenue bonds **(p 59).**

SYSTEM PLANNING ▶ **One of the most complicated and demanding duties** faced by utilities is to plan system expansion, establish requirements for generation margins, transmission and distribution performance. Because system planning for each utility must be a custom job, experts in the field have long ago given up compiling a list of preferred standards. But a subcommittee of the EEI Electrical System and Equipment Committee has done the next best thing. It has compiled a report of the planning practices of 46 electric utilities. It lists specific practices in the major fields of system planning. In a sharp condensation of the EEI report, Electrical World presents the most important trends in today's system planning **(p 75).**

DISTRIBUTION ▶ **Custom equipped service truck helps keep Toledo Edison's automotive fleet in shape.** The service truck is used for nightly check of vehicles in four outlying parking areas. Saves frequent trips to central repair garage **(p 83).**

METERING ▶ **Virginia Electric & Power leads the way with a new sampling technique** for meter testing that replaces the old periodic testing routine.

Modern statistical sampling methods are used to help point out areas or meter types most susceptible to inaccurate metering. State commissions in Virginia, West Virginia, and North Carolina have approved the new technique which cuts costs in the beginning and promises more economies and greater accuracy in the future. Ultimate solution to the meter accuracy problem, writes VEPCO Meter Supt. W. C. Harrison, is development of a low-cost, single-phase watthour meter which will maintain desired accuracy for its life of 20 to 30 years and then be replaced by a new one (p 72).

Here's a step toward more flexible use of polyphase meters. Merely by changing internal connections of the 2-stator, 4-wye circuit unit, it can be used on 4-wire delta circuits as well. Read how (p 86).

SELLING ▶ **Cost cutting and smaller discounts** from distributor are big problems facing appliance dealer. But those who would guess think profits should equal or better the 1956 figures (p 94).

Production up, annoyances down. That's the story at Jersey Shore Steel Co which recently shifted from its own steam plant to purchased power (p 103).

HEATING & COOLING ▶ **Florida Power Corp's "Weather by Wire" promotion campaign** gives healthy boost to air conditioning sales . . . Gas utilities added 1.3 million space heating customers during the past heating season. That's more than one for every new home built during the period (p 98).

MANAGEMENT ▶ **Equipment price increases are coming in** a pretty steady clip so that pattern is apparent. Higher steel costs and rising labor costs are given as reasons for the price rises (p 135).

PEOPLE ▶ **At Potomac Edison, D. E. Stultz is new president** . . . At Bonneville Power Administration, J. Lane Morthland is new assistant administrator . . . At Charles T. Main, consulting engineers, Wilfred M. Hall is new president (pp 140, 142).

MANUFACTURERS ▶ **Ohio Brass has in production a new line of lightning arresters** which allows almost a 90% transfer of power-follow current limiting resistance, and duty, from valve blocks to the series gap element (p 126) . . . Combustion-Engineering receives boiler orders totalling $25 million in 6 weeks . . . GE delivers stator to Boston Ed over 600 mile route (p 124).

NEW EQUIPMENT ▶ **New rubber-tired earth boring and pole-setting vehicle** permits operation without tearing up terrain, has road speed up to 55 mph . . . Pole bearing plates prevent uplift forces from pulling single pole out of ground or upsetting balance of poles in H-frame . . . Silicon rectifiers are available for electrostatic precipitators. They are immersed in oil with transformers (p 106).

ENGINEERING TRENDS

Recovery voltage will become part of circuit breaker application routine just as interrupting duty has been for many years. A series of papers at the AIEE Summer General Meeting made the need very clear and also conveniently offered satisfactory short-cut methods for approximating solutions.

Savings from dc transmission are estimated at $24 million for New Zealand's Cook Strait crossing, compared with $32.3 million cost for a 600-Mw ac cable system. At the ultimate 1,200-Mw capacity, these savings soar to $53 million.

High attenuation makes carrier protection difficult for long cable links. And the low surge impedance of high-voltage cable makes 6 db mismatches at every open-wire junction to cause additional attenuation. Neither is microwave always a satisfactory solution because reflections from water sometimes complete a second signal path to cause fading by cancellation of the direct-path signal.

Wire and a lead pellet remain the preferred seal for metering equipment. According to a recent survey, 74 of 75 utilities reported using them for sealing meters, and 54 for register type and other demand meters, but 37 prefer other types of seals for transformer enclosures.

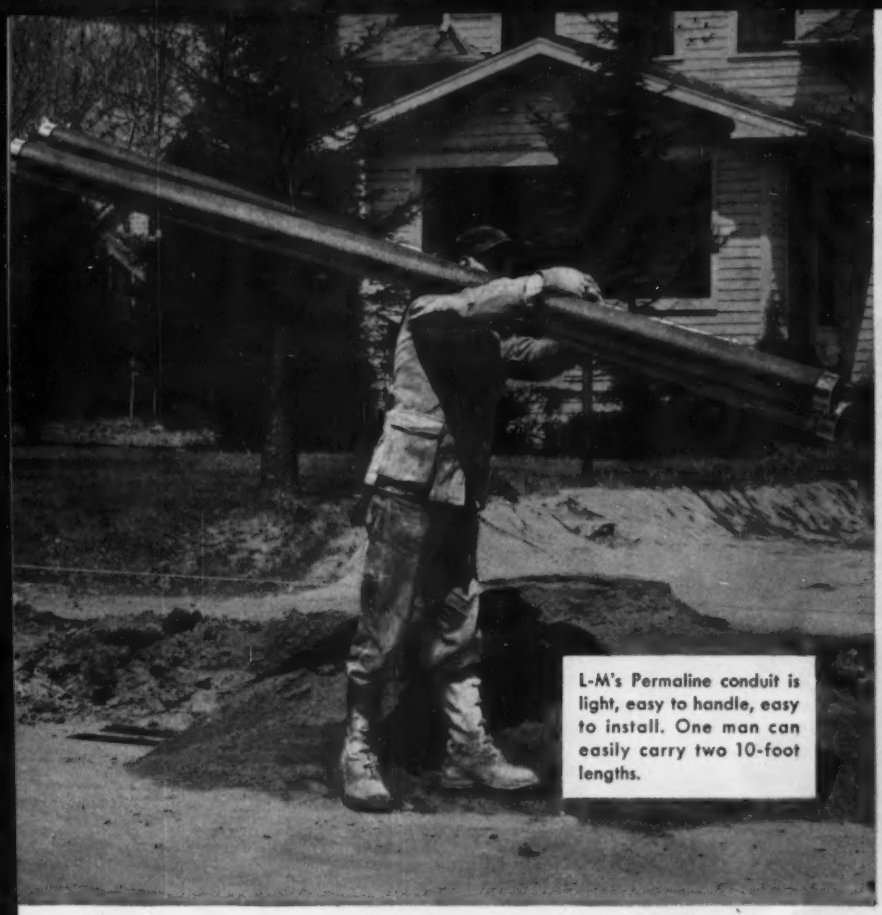
Higher voltage for high-current tests is provided by series-connecting two generators. A transformer connected across corresponding portions of the machines' windings stabilizes them at the 180-deg angle during the test interval.

Resistance inserted into the circuit by 2-step switching, as well as resistance inherent in the circuit, helps materially to clear large shunt capacitor banks without damaging restrikes in the circuit breaker or severe voltage transients on the capacitors.

FROM EDITORS IN THE FIELD

Turbine blades to 46 in. are planned for exhaust stages of future units, after successful rolling of Commonwealth Edison Co's Will County No. 3 last month. This unit has the first 43-in. blades, forerunners of the new series.

Aluminum cable can be used for secondary network mains whenever market conditions swing the balance that way. This flexible position has been won by Consolidated Edison Co in a 5-year program which developed crab joints and limiters for aluminum as well as techniques for splicing the aluminum to existing copper cables. But problems encountered with bare aluminum neutrals may require either insulation to guard against corrosion or retaining bare copper for the neutrals.



L-M's Permaline conduit is light, easy to handle, easy to install. One man can easily carry two 10-foot lengths.

L-M's extra-long 10-foot lengths of Permaline conduit speed installation. Simply tapping the tapered coupling onto the tapered end of the conduit makes a strong, watertight joint—no caulking needed.

Saves Time and Labor...

Contractor Eliminates 13,750 Joints

With Long 10-foot Lengths of L-M Permaline Conduit!

Now, with L-M's exclusive 10-foot lengths of Permaline fibre conduit, you can eliminate 20% to 50% of the joints to be made on a job, and thus cut costly construction time and labor.

On one job requiring 550,000 feet of conduit, the contractor eliminated 13,750 joints by using L-M's long 10-foot lengths as compared with 8-foot lengths.

It will pay you to use L-M's time- and labor-saving 10-foot lengths of Permaline conduit for your next duct job. Only L-M Permaline is available in these 10-foot lengths.

Easy to Install

L-M lightweight Permaline fibre conduit is also easy to install. Joints are quickly made by simply tapping the tapered coupling onto the tapered end of the conduit. Joints are watertight and safe from seepage. Smooth bore reduces cable sheath abrasion. Completely engineered system for installation includes full line of bends, bell ends, couplings, and base and intermediate spacers.

L-M Permaline fibre conduit comes in 5, 8 and 10-foot lengths. Available diameters include 2, 3, 3½, 4, 4½, 5 and 6-inch sizes.

Get Complete Information

Ask the L-M Field Engineer for a copy of the 12-point plan folder which shows how easy it is to use the Permaline system; or Fibre Conduit Bulletin UG1A, which gives complete specifications. Or write Line Material Industries, Milwaukee 1, Wisconsin.

310

LINE MATERIAL Industries

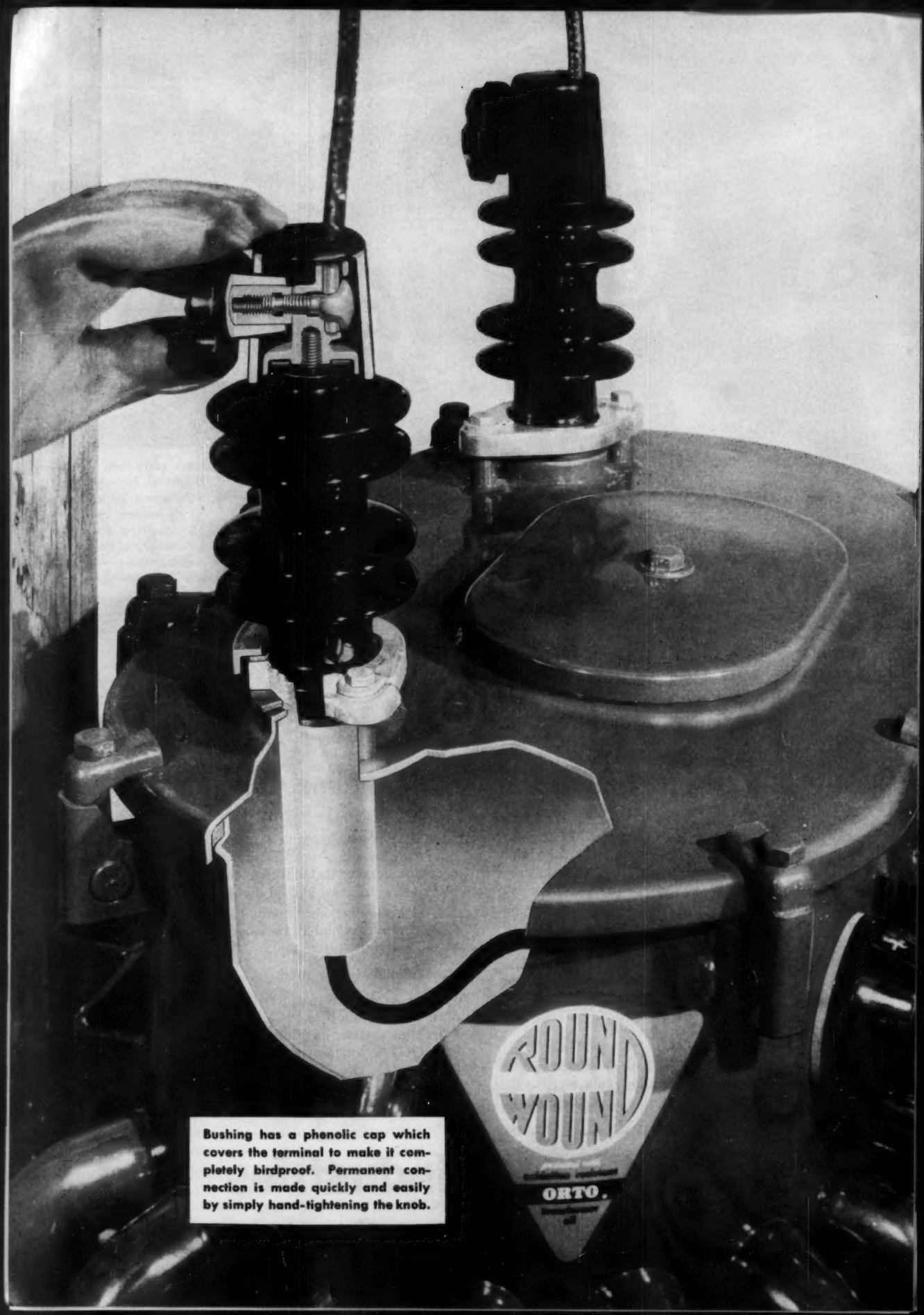
McGRAW-EDISON COMPANY

McGRAW EDISON

Permaline Fibre Conduit

BPI

This seal is your guarantee of recognized quality in Bituminous Fibre Conduit.



Bushing has a phenolic cap which covers the terminal to make it completely birdproof. Permanent connection is made quickly and easily by simply hand-tightening the knob.

Here's Why

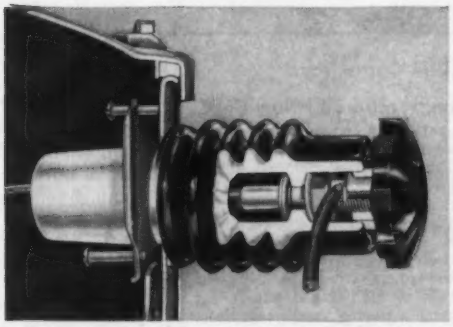
L-M Bushings Reduce Outages– Assure Safe, Easy Installation

By **R. W. HARTSOOK**
Chief Engineer
Small Distribution Transformers
Line Material Industries

Both the cover-mounted and sidewall-mounted high-voltage bushings on L-M transformers are fully insulated to eliminate outages caused by birds and animals contacting the terminal. The bushings also have a hand-tightening knob so terminal connection can be made securely, with ease and safety.

Standard Arrester Mounting

The cover bushing has a phenolic cap which covers all exposed live parts of the bushing. The cap has a drain to prevent water accumulation. When lightning arresters are installed as part of the transformer unit, they can be mounted in the regular manner and gapped through a slot provided in the insulating cap.



Cutaway view of bushing shows the heavy connector that grips the conductor. Handle cannot come off accidentally, but it can be removed intentionally.

Good Clamping Pressure

The connector knob on the bushing is large, giving plenty of leverage. A firm connection is made quickly and easily without tools or removal of any parts. Even with a gloved hand the lineman can get a good grip, so hand-tightening is all that is necessary for a permanent connection.

Bushing connectors comply with all EEI-NEMA specifications, including vertical take-off.

Sealed Against Moisture

The cover bushings on L-M transformers are externally clamped to a cover boss which is raised well above the surface of the cover. Between the boss and the wide skirting of the bushing is a corprene gasket which assures excellent sealing. Surface moisture cannot flow into the bushing entrance.

A simple two-piece external clamp holds the cover bushing firmly in place. No nuts or clamping parts are used internally. The porcelain can be removed or replaced quickly and easily without removing the tank cover.

Sidewall bushing design is also leak-proof and inherently siphon-proof—moisture can't be drawn in; oil can't seep out. Sturdy internal clamping reduces the length of porcelain on the outside of the tank and thus reduces the required pole space.

Get Complete Information On L-M's Round-Wound® Transformers

L-M's bushing design is only one of many plus features found on L-M Round-Wound transformers. The most important thing about these transformers is their outstanding performance. Ask your L-M Field Engineer for complete information and bulletins. Or write Line Material Industries, Transformer Division, Zanesville, Ohio.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY
Transformers

McGRAW EDISON

HOW L-M INDUSTRIAL CAPACITORS GIVE A HIGH RETURN ON INVESTMENT

Raise low power-factor and reduce kilovars

...increase load capacity
...improve voltage conditions
...cut power bill

By N. K. DELANEY
Product Manager
Capacitors and Regulators
Line Material Industries

Low power-factor costs you money. With low power-factor you do not use your plant facilities efficiently. You also lose part of the electricity you pay for, because of excessive losses. Today, practically every plant has manufacturing processes with loads involving induction motors producing low power-factor. These are such loads as machine tools, pumps, fans, compressors and conveyers.

The use of capacitors improves the power-factor of the load. This reduces the KVA demand, and therefore cuts power costs. It automatically increases the load capacity of the plant circuits, and provides better voltage for equipment operation and lighting. In addition to providing better operation of the plant, capacitors can substantially reduce power costs another way: where there is a power-factor clause, based on a study of the clauses of a number of utilities, capacitors can save many times their cost.

Both Large and Small Plants Benefit

Almost every size of plant having a power-factor clause in its rate structure can justify capacitors. Studies show that it is generally advantageous to improve the power-factor beyond the maximum rate of return, because even though the rate of return becomes less, it is still economically attractive, and besides, additional system power capacity is released. A rough rule is to provide improvement to 90-95 percent power-factor.

The best way to determine the capacitor kilovars to use is to calculate the actual dollar savings for various power-factor values for your particular plant condition. See examples at left.

Location of Capacitors

The maximum benefit from capacitors is obtained when they are located

Two Examples of Savings With L-M Capacitors

These two examples are typical of the savings on power bills possible through the application of low-voltage industrial capacitors.

1. Small Industrial Plant

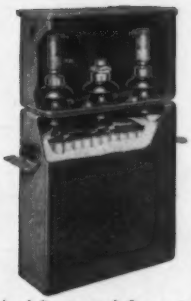
Here the rate structure included a monthly KVA demand charge, which averaged $172.28. Installation of $720 worth of capacitors cut the demand charge to $137.80, a monthly saving of $34.48. The savings will pay for the capacitors in 21 months. Here are the figures:

BEFORE Installing Capacitors		
KW	=	152
KVA	=	211
PF%	=	72
Monthly KVA demand charge.	=	$172.28
AFTER Installing		
80 KVAR of 460 Volt Capacitors		
Approximate installed cost of capacitors	=	$720.00
KW	=	152
KVA	=	166
PF%	=	92
Monthly KVA demand charge.	=	$137.80
Reduction in monthly KVA demand charge	=	$ 34.48
Number of months required to pay for capacitors out of savings in monthly KVA demand charge	=	21

2. Commercial Lighting User

Here the rate for a commercial user of a large amount of lighting equipment included a monthly KW demand charge with a power-factor penalty clause as follows: the monthly demand charge will increase 1% for each 1% the power-factor falls below 85%PF. Power-factor at the time was running around 76%. Installation of enough capacitors to bring the power-factor to 86% saved $24.41 per month, which is paying for the capacitors in 25 months. It figures out this way:

BEFORE Installing Capacitors		
KW	=	120
KVA	=	158
PF%	=	76
Monthly KW demand charge.	=	$295.66
AFTER Installing		
30 KVAR of 230 Volt Capacitors		
Approximate installed cost of capacitors	=	$600.00
KW	=	120
KVA	=	140
PF%	=	86
Monthly KW demand charge.	=	$271.25
Reduction in monthly KW demand charge	=	$ 24.41
Number of months required to pay for capacitors out of savings in monthly KW demand charge	=	25



Individual Dustproof Capacitor Unit

at the load. This is true for release of system capacity, voltage improvement, and power bill savings. On the other hand, other factors should be considered, such as load diversity, particularly when the plant contains a number of small loads. L-M engineers can help you with such problems.

Complete Engineering Service

As a large manufacturer of capacitors for utility applications, Line Material Industries offers complete engineering service on industrial capacitor installations.

Line Material development engineers will cooperate with you to determine the amount of capacity released by power-factor correction, voltage improvement, rate of return on capacitor investment, and the most advantageous capacitor location.

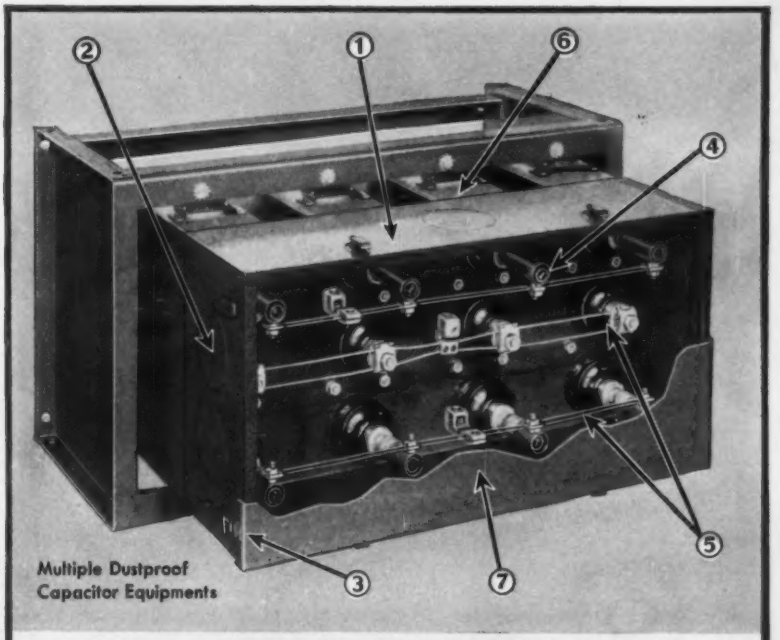
Complete Line of Industrial Capacitor Equipments

Line Material Industries offers a complete line of standard industrial capacitors, 230 to 575 volts, for installation at the motor, on the supply side of motor protective and switching devices, or at load centers.

Line Material capacitor equipments are dustproof. They can be floor, wall, or ceiling mounted. Multiple equipments are factory assembled into desired sizes, and completely wired. Installation is simple and fast. Equipments include boric acid indicating-type, terminal-mounted fuses.

Get Complete Information

Line Material capacitors may be the solution to your problem to increase load capacity, improve voltage conditions, or cut power billing. Call the nearest Line Material office for complete information and the location of the nearest distributor of Line Material equipment. Or write Line Material Industries, Milwaukee 1, Wisconsin.



Multiple Dustproof Capacitor Equipments

NEW L-M INDUSTRIAL CAPACITOR EQUIPMENTS

Have Outstanding Design Features

1. ***Enclosure***—one-piece all-steel construction.
2. ***Knockout***—3-inch on all four sides.
3. ***Cover***—one-piece, fastened by spring clips, easily removed.
4. ***Fuses***—boric acid indicating type, terminal mounted.
5. ***Internal Wiring***—factory assembled.
6. ***Unit***—strong solder-sealed bushings with low temperature Elemex liquid dielectric.
7. ***Finish***—primer followed by one coat of alkyd-resin paint.

Available in standard three-phase and single-phase ratings, 230, 460, and 575 volts.

Sold to industry through distributors. Call the nearest Line Material office for location of nearest distributor or write Line Material Industries, Milwaukee 1, Wisconsin.

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McGRAW-EDISON COMPANY

Transformers—Capacitors—Reclosers
Protective Equipment—Street Lighting
Power Switching Equipment—Regulators
Line Construction Materials—Fibre Conduit.

McGRAW EDISON

311

Over the entire 156-mile length of the new Indiana Toll Road, interchanges and service plazas are illuminated by lighting standards of Alcoa Aluminum. They were fabricated by The Union Metal Manufacturing Company, Canton, Ohio.

HERE'S WHY 1,700 LIGHTING STANDARDS ON THE INDIANA TOLL ROAD WILL NEVER NEED PAINTING

The answer, of course, is Alcoa® Aluminum! Lighting standards made of Alcoa alloys defy corrosion, both inside and outside. As a result, wall strength remains constant and poles keep their attractive appearance for life without any need for expensive, protective painting.

Savings mount in other directions, too. Aluminum standards weigh less than half as much as those of other materials, so they're less costly to ship, handle and erect. Yet there is no sacrifice of needed strength. Poles made of Alcoa Aluminum have withstood wind loading in excess of 100 mph. In fact, no wind damage to an aluminum lighting standard has ever been reported.

Add up the economies that start with faster, easier installation and increase year by year through elimination of painting. Then, if you plan to buy lighting standards, write us for the names of leading manufacturers who make them of Alcoa Aluminum. Aluminum Company of America, 1977-G Alcoa Building, Pittsburgh 19, Pa.

Your Guide to the Best in Aluminum Value

WE CHOSE ALCOA ALUMINUM MILL PRODUCTS
ALUMINUM COMPANY OF AMERICA

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

FREE...

New 24-Page Treatise on Instrument Transformers

INSTRUMENT TRANSFORMERS
Theory and Operation
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Page
Function . . . 2
Types . . . 2
Polarity Marking . . . 2
Coordination of Insulation . . . 3
Impulse Protection . . . 3
Accuracy . . . 5
Performance Curves . . . 6
Potential Transformers . . . 9
Current Transformers . . . 14
Ratio-Phase Angle Correction Chart . . . 21
Corrections and Overall Accuracy . . . 22
Factory Tests . . . 22
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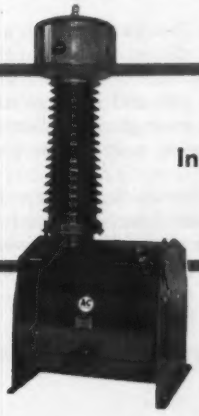
UTILITY metering superintendents, industrial electrical engineers, switchboard builders — here's a desk-mate you will consult often and profitably. Instructors in engineering schools and on-the-job training programs — you will want to use this informative bulletin as a textbook. It's the most complete treatise ever compiled on the theory and operation of instrument transformers.

Included are comprehensive data presented in handy reference form, typical performance curves and a handy ratio-phase angle correction chart.

Single or quantity copies are yours for the asking. Write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



Allis-Chalmers Instrument Transformers Available in Over 400 Ratings

Name the application. There's an Allis-Chalmers instrument transformer that fills the bill precisely. Indoor, outdoor, dry-type, oil or compound-filled units — they are all available in the widest possible rating range.

ALLIS-CHALMERS

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NEW UTILITY STATIONS, C-E EQUIPPED
Includes only new stations on new sites placed in operation since JANUARY 1, 1950.

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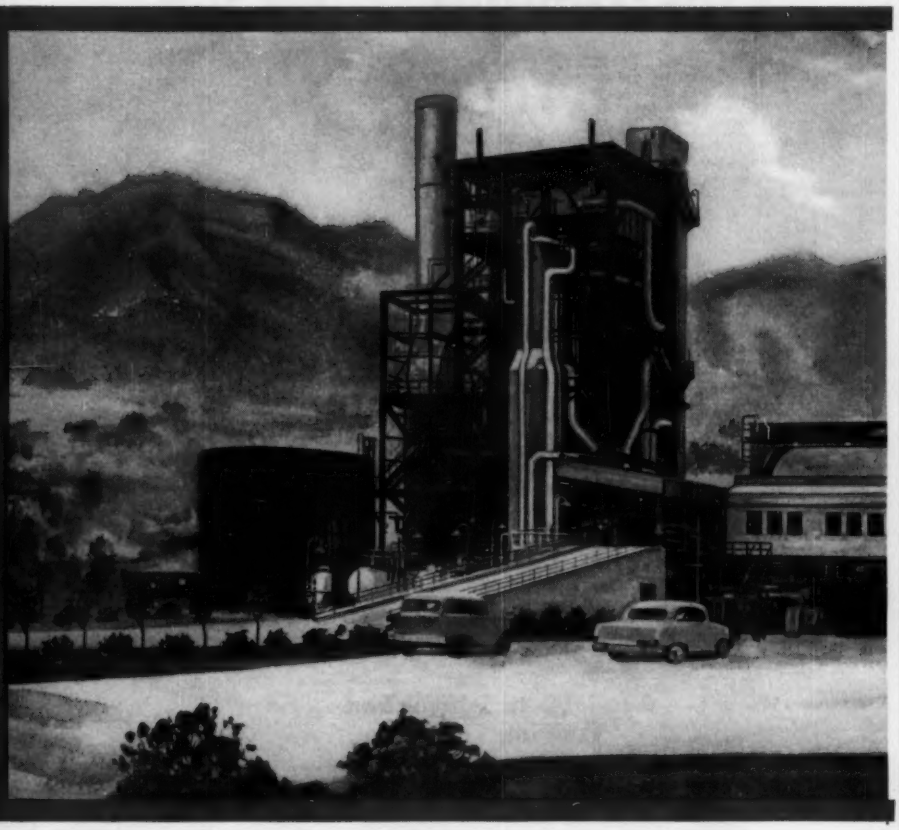
SAN BERNARDINO

New San goes

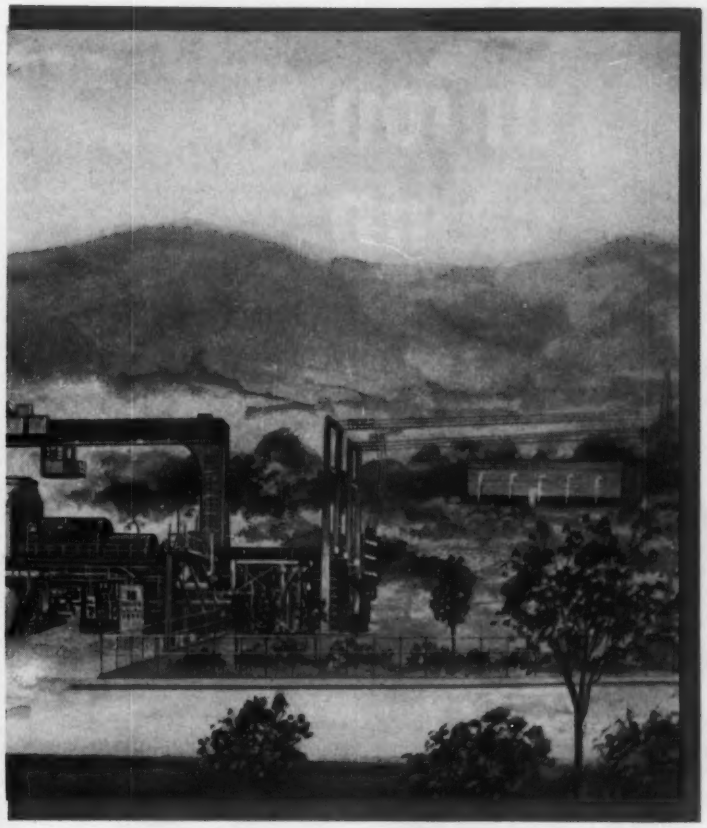


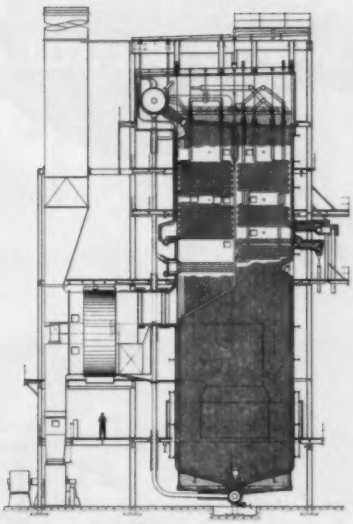
Unit No. 1 of California Electric Power Company's new San Bernardino Steam Electric Generating Plant was recently placed in operation. The 60,000 kilowatt unit is the first of a series of four units planned for this site to meet the power demands of an ever-growing Southern California. A second 60,000 kilowatt unit will be placed in service in mid-1958.

Located near the city of San Bernardino, this modern station of outdoor design was planned and constructed by the Fluor Corporation under the general supervision of Calectric's engineering department. Its power will be

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED

Bernardino Plant
into service





The C-E Unit shown above is now in service at the San Bernardino Steam Electric Generating Plant. A duplicate is presently under construction. These are radiant, reheat boilers with the reheater section located between the primary and secondary superheater surfaces which are directly above the furnace. An economizer section is located below the rear superheater surface and regenerative air heaters follow the economizer section. Steam is produced at a pressure of 1850 psig and a temperature of 1000 F, reheated to 1000 F. The unit is fired with natural gas and oil employing tilting, tangential burners.

transmitted at 115,000 volts to an electric service area that is one of the fastest-growing in the United States.

The San Bernardino plant is one of a number of power-producing facilities that Calectric is building throughout its service area. Four units at Highgrove are already in operation, and new units will be constructed soon at Barstow and on the Colorado River.

Steam for the new units at San Bernardino will be supplied by C-E Steam Generating Units, a cross-sectional elevation and brief description of which appear at the upper right.

C-102

COMBUSTION ENGINEERING

Combustion Engineering Building

200 Madison Avenue, New York 16, N. Y.

EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

The linking of these two famous symbols . . .

AMCRECO
PRESSURE TREATED WOOD PRODUCTS
union camp

means *Better Service*

for users of treated wood!

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BRIDGE TIES
POLES
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PILES
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The American Creosoting Corporation, a pioneer in the development of the wood preserving industry has joined forces with Union Bag-Camp Paper Corporation—one of the nation's most progressive manufacturers of products from wood.

As a result, AMCRECO'S technical skill and experience, developed through half a century of serving the largest users of treated wood, is now reinforced by Union-Camp's resources.

Convenient plant locations, extensive resources and experienced personnel have been teamed to provide you with a new standard of service and dependability. This will be reflected in modernized facilities, improved deliveries (from stock in many cases) and careful attention to your specifie requirements.

Let us show you how this new organization can be of help to you.

Time is Our Best Testimonial

AMCRECO
PRESSURE TREATED WOOD PRODUCTS
union camp

571

AMERICAN CREOSOTING CORPORATION
Louisville 2, Kentucky
18 Strategically Located Treating Plants to Serve You
Subsidiary of
UNION BAG-CAMP PAPER CORPORATION

DUAL VOLTAGE transformers

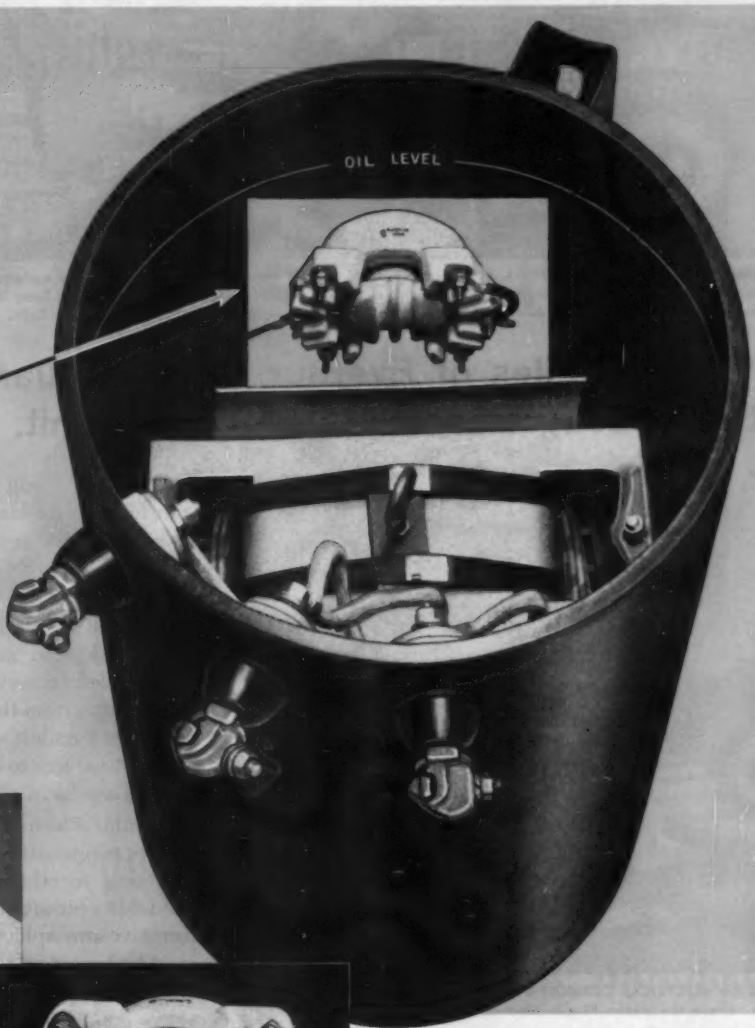
MEAN SAVINGS IN MONEY, TIME, LABOR

You save in stocking requirements . . . one unit can be stocked where it now takes two.

You save transformers from obsolescence when system voltage is increased.

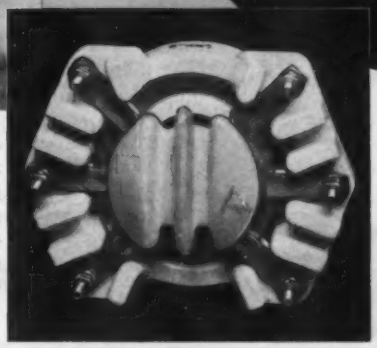
You save on change-over, cutting both down time and labor time.

Voltage change-over switch is mounted on the inside of the tank, under the oil level. It is fully operable from outside the tank.



Switch is sealed and protected from damage by removable screw cap and neoprene gasket.

Simple operation! Remove screw cap and reverse, using cap as handle for rotating switch.



Switch is rotary-bridging-to-position type, with both positions clearly identified by a stamped plate on the switch. Body constructed of wet process electrical porcelain with ample creepage. Fully impulse tested by NEMA standards.

For positive protection against puncture, flashover, or lightning failure the entire transformer is always insulated for the basic insulation level of the highest name plate voltage.

Available in	**2400 x 4800 volt** **2400 x 7200 volt** **4800 x 14,400 volt** **7200 x 14,400 volt**	**from 10 through 100 KVA.**

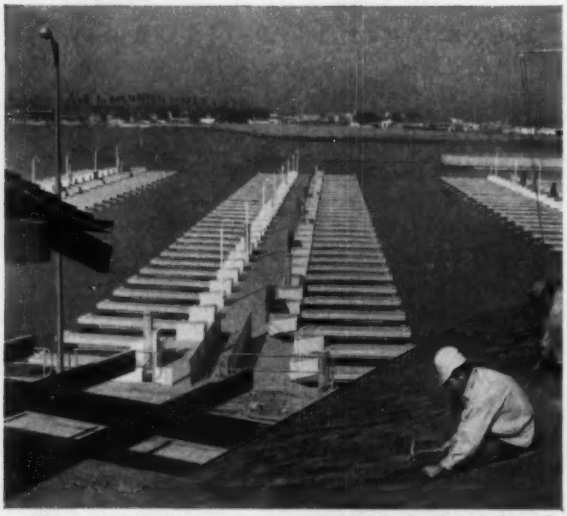
Like all RTE Transformers, dual voltage models are backed by a five year guarantee. They are available from conveniently located warehouses throughout the U.S.

HELPING PROVIDE POWER FOR AMERICA

RT&E CORPORATION
WAUKESHA, WISCONSIN

ALAMITOS BAY MARINA BASIN #1, built by the City of Long Beach, Calif: S. E. Vickers, city manager; J. D. Gilkerson, city engineer; B. E. McCune, deputy city engineer; Thomas G. Marchese, project engineer. Engineers: Moffatt & Nichol Inc., Long Beach. Electrical contractor: Ets-Hokin & Galvan, Wilmington, Calif. Everdur Conduit furnished by General Electric Supply Company, Long Beach, Calif.

Over two miles of Everdur Conduit guards electric service at new Long Beach, Calif., marina unit, serving 342 boats



EVERDUR ELECTRICAL CONDUIT is installed under floating docks, only inches above the water. Plug-in electrical outlets are located at lockers by each slip and on lighting standards. *Below:* Everdur Electrical Conduit is available in two wall thicknesses—R. C. and E. M. T.

PHOTOS COURTESY INDEPENDENT-PRESS-TELEGRAM, LONG BEACH, CALIF.

The City of Long Beach, Calif., is in the process of transforming its Alamitos Bay area from tide flats and a massive mosquito factory into one of the finest small boat harbors in the world.

The first boat basin and marina unit, which can accommodate 342 boats, is now complete. The floating docks are well lighted and at each slip, boat owners have plug-in electric service and a fresh water tap. All electrical wiring from the shore out is protected by Everdur® Electrical Conduit – well over 11,000 feet, ranging from ½" nominal size to 3". In addition, all fittings and boxes are of Everdur.

Everdur Electrical Conduit – made from one of Anaconda's copper-silicon alloys—never rusts and offers high resistance to other types of corrosion. It provides dependable year-after-year protection wherever water and corrosive atmospheres are a problem – or where conduit must be buried or embedded in concrete. Everdur is also tough – it stands up under movement and vibration.

For detailed information, write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

57136

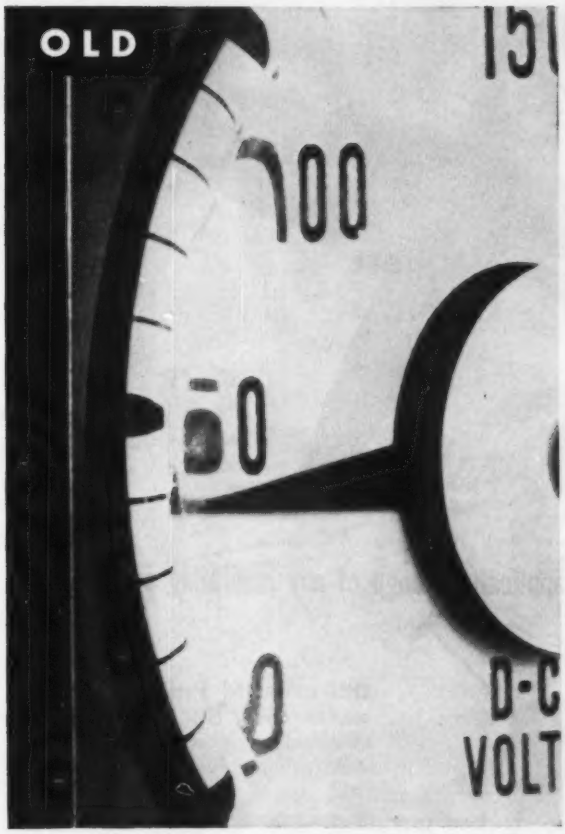
EVERDUR
ELECTRICAL CONDUIT

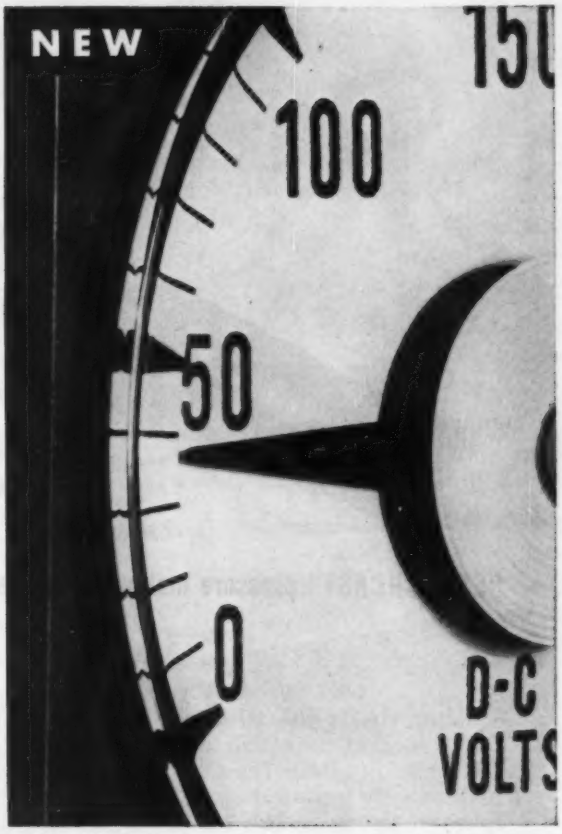
an ANACONDA® product
made by The American Brass Company

CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE

No squint . . . no guess . . . no strain . . .

General Electric Switchboard Instruments Offer You Widest Angle of Readability*





*120-DEGREE ANGLE OF READABILITY (300% OF ASA STANDARDS) HELPS REDUCE READING ERRORS, SAVES OPERATORS' TIME

Switchboard instruments by General Electric offer a higher degree of readability than ever before possible . . . helping give faster, more convenient, more accurate readings.

Giving you 3 times the angle of readability established by ASA standards, they can be read easily, surely from any position around an overall angle of 120 degrees. This not only permits faster, more accurate readings on overhead or long switchboard panels, but also allows added flexibility for more economical installations.

Here's added reasons why G-E switchboard instruments are easier to read: parallax errors eliminated by placing pointer in same plane as scale . . . new, convex glass cover prevents shadows caused by overhead lighting . . . long 250-degree scales permit use of larger numerals.

General Electric offers you a complete line of switchboard instruments, including new weathertight models for outdoor panels or inside applications where there is splashing or corrosives, dust, or oil particles in the air.

For more information, contact your nearby G-E Apparatus Sales Office or write to General Electric Co., Section 582-27, Schenectady 5, N. Y. for your free copy of bulletin GEC-218E.

GENERAL ELECTRIC

New pressure-splice method insulates even this complex splice!

"SCOTCHCAST" pressure method has widest application range of any insulating system!

THIS "UNIPAK" container holds the laboratory-correct mixture of "SCOTCHCAST" Resin No. 4 to make a fast, factory-quality splice in the field. This new Pressure-Splice method affords the utmost in excellent physical, electrical and moisture protection—consistently, splice after splice—*with any combination of cables and any combination of insulations.*

THIS new 3M Pressure Gun makes the "SCOTCHCAST" method practical, simple, and positive for any type of field splice where the size, shape, position, or inaccessibility of the splice make other splice insulating methods difficult. This gun was specially designed for the new Pressure-Splice method; makes insulating splices a neat, clean, quick, and *permanent* job.

SEND FOR *complete information on the new "SCOTCHCAST" Pressure-Splice method for field use. Just write on your letterhead to: 3M Co., St. Paul 6, Minn., Dept. BV-77.*

REG. U.S. PAT. OFF.
SCOTCH BRAND Electrical Products

by the makers of
REG. U.S. PAT. OFF.
SCOTCH BRAND
No. 33 Electrical Tape

The term "SCOTCH" and "SCOTCHCAST" are registered trademarks of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N. Y. In Canada: P.O. Box 757, London, Ontario.

MAJOR SERVICE ADVANCES

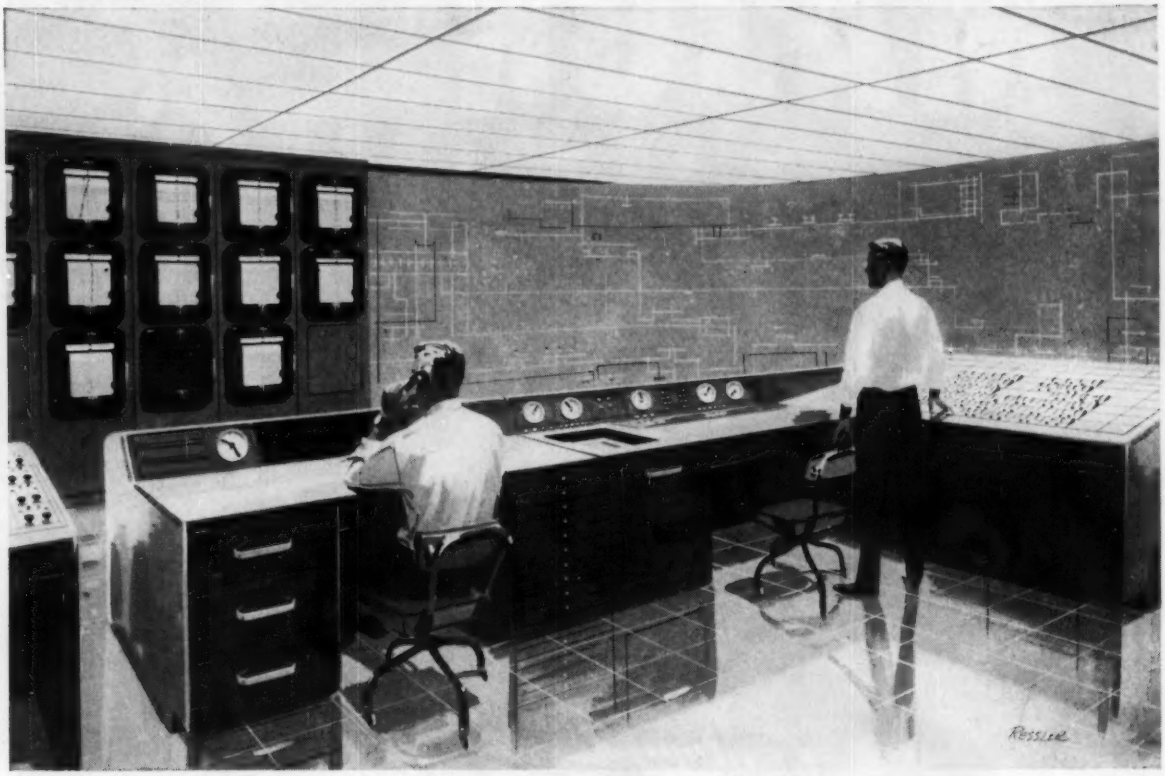
. . . our new signature appears above. It marks the start of new advances at Standard. We're now associated with American Gage and Machine Company. To supplement our own excellent staff we'll draw on experts from: Size Control — they're establishing new quality control methods for us; Walsh Press — improving our fabrication methods; Batavia Body — they're developing new welding techniques for us; Simpson Electric Company — they're revamping our test department. We've added outstanding, new representatives to provide better service in new territories. These changes will give you improved service from our offices and better performance than ever from rugged Standard Transformers.

LIVE BETTER ELECTRICALLY

Standard Transformer CO.
WARREN, OHIO
"WHEREVER THERE IS POWER"

Phone 2-1563

Another L&N solution to the area regulating problem



Miami Dispatcher's Office prepares for closed-loop operation on incremental cost-of-delivered power basis. They've ordered . . .

New "Desired Generation" Computer to integrate with present Florida Power & Light Area Control

Written by J. F. Springman, Leeds & Northrup Co., for this advertisement

• Because so many industries are building plants in Florida, FP&L has taken bold steps to keep up with an astonishing load growth: generating capability has more than quadrupled since World War II. Not content with the addition of 800,000 kw in that period, FP&L's operating people have given the green light for installation of the most advanced operating tool—a transistorized Desired Generation Computer.

A True Computer

Not only will the new computer mastermind automatic control of 19 units in all eight major plants, but it also can be used to solve complex load problems as an independent unit when disconnected from the control system. During the time the computer is used for other problems the control continues under the direction of the present equipment. When performing its control function, the computer will coordinate incremental transmission and generating costs using incremental heat rate, fuel cost and performance factor data. It will also be used to determine economic dispatch of 24 units—97 per cent of system capability. As a result, FP&L's already advanced Area Control will be boosted to a technological level exceeded by no other utility in the world.

Noteworthy Prediction

A 1948 board study of the FP&L system formed the basis of an AIEE paper* co-authored by FP&L's Manager of Power Supply, H. W. Page. This paper helped pave the way for development of dispatch computers

**AIEE Transactions T9242 "Coordination of Fuel Cost and Transmission Loss by Use of the Network Analyzer to Determine Plant Loading Schedules" by E. E. George, H. W. Page and J. B. Ward.*

Continued on page 120

He's doing maintenance for you!

New Epoxy Finish Eliminates Painting as a Factor in Capacitor Maintenance

The maintenance section in the Varex instruction bulletin is very short. The reason: there's hardly any maintenance required.

Painting is virtually eliminated as a factor because each Varex container gets three protective coatings — zinc spray, zinc chromate primer, and epoxy resin paint.

Epoxy is a new finish, proved superior to other resin-base paints on all counts . . . corrosion resistance, abrasion resistance, flexibility and adhesion.

Consider, for example, how epoxy performed under an accelerated salt spray test, with a five per cent salt solution. Paint A, an alkyd base paint ordinarily used for this class of electrical material, broke down after 166 hours. But Varex epoxy was still good at 1250 hours when the test was stopped!

On the basis of such tests, we know the indicated life of Varex epoxy is several times that of any other paint now available for capacitor applications.

Use of epoxy paint is just one of several ways the makers of Varex are doing your capacitor maintenance for you.

Ohio Brass

MANSFIELD, OHIO, U. S. A.

4761-H

NOW WE INSPECT INSULATORS ALL THE WAY THROUGH

New Ultra-Sonic Method, Related to Radar, Assures Freedom From Previously Hidden Flaws

It's like looking right through the porcelain -- inspection with ultra-sonic vibrations. The smallest hidden flaws reveal themselves to this modern equipment. Critical porcelain sections are given this treatment to assure perfection, inside as well as out.

Very high frequency ultra-sonic vibrations are beamed into the porcelain mass. Their reflections appear as a pulse pattern on the oscilloscope screen. Any internal void or check shows as a characteristic pip. The operator can not only locate but evaluate the condition. He can see through the insulator!

Porcelain lends itself ideally to this internal, nondestructive examination by a modern technique closely related to Radar.

Another step has been taken in the direction of still higher reliability in O-B materials; proof of our intention to make O-B insulators better than ever -- a better buy than ever!

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

TECHNICAL COMPETENCE

Ohio Brass

4819-H

THE HEART OF EVERY (B) INSULATOR

PRINTED IN U.S.A.

inexhaustible energy for the future's heaviest loads

B&O **BITUMINOUS COALS FOR EVERY PURPOSE**

Ask our man! BALTIMORE & OHIO RAILROAD—BALTIMORE 1, MD. PHONE LExington 9-0400

WHAT BLACKBURN HAS UP ITS SLEEVE!

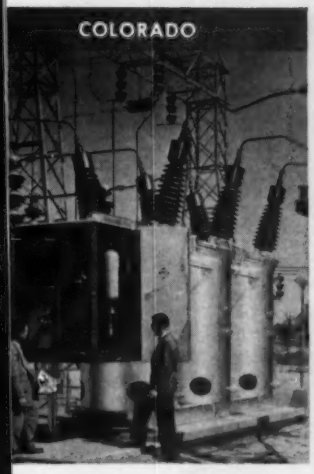
Blackburn Compression Service Entrance Sleeves Feature

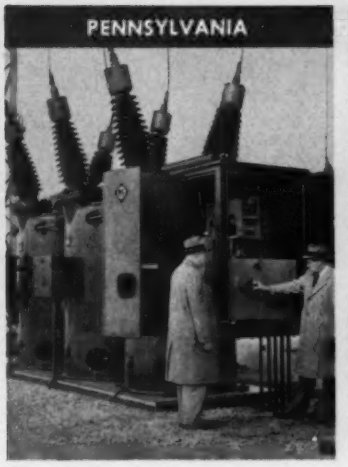
- Body of highly conductive aluminum that fits all standard compression tools. Can be used for all combinations of aluminum ACSR and copper conductors.
- Bores of each tube are filled with CONTAX, a mineral base grease with metallic and abrasive particles held in suspension. It has an ASTM drop point of 549° F.—improves conductivity—prevents corrosion.
- Solid metal barrier between bores assures even distribution of CONTAX all around conductors when crimps are made.
- Push conductor through thin wall, color coded caps—no need to remove them before inserting conductor—they do not interfere with installing die. Colors will not run or fade. Sizes cover a wide range of conductor combinations.

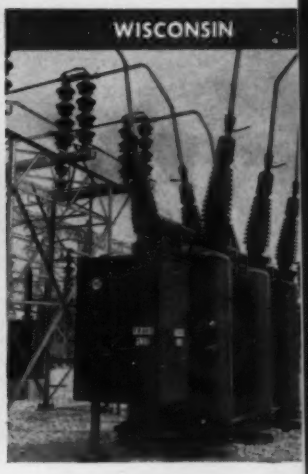
Available at Electrical Wholesalers Everywhere.
Wire or write for bulletin on Blackburn Compression Fittings.

JASPER BLACKBURN CORPORATION 1525 WOODSON RD., ST. LOUIS 14, MO. WYDOWN 3-9430

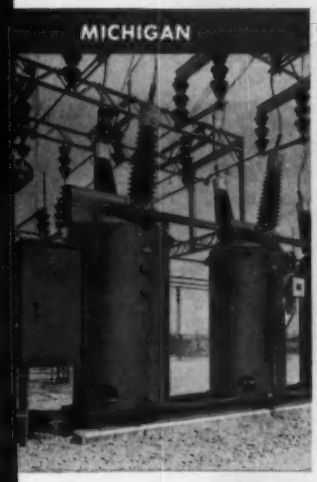
Utilities everywhere like Pneu-Draulic operators

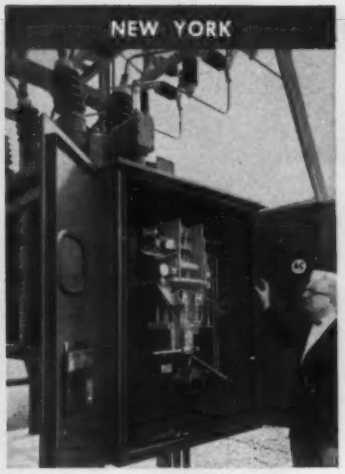






for their simplicity, reliability





***Pneu-Draulic* operators offer Utilities many advantages:**

- Simplicity — Compact design with few moving parts.
- Eliminates moisture, and corrosion problems — Entire system filled with oil containing inhibitor which eliminates rust, freezing and corrosion.
- Safe emergency closing — Breaker can be closed *safely* at full rated speed onto energized line even when no control power is available.
- Mechanically trip-free operation — Fully mechanically trip-free for complete system protection.
- Available on a wide range of breaker ratings — Breakers rated 500 mva and larger use the *Pneu-Draulic* operator as standard equipment.

Get details on these and other features of Allis-Chalmers breakers. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Pneu-Draulic is an Allis-Chalmers trademark.

A-5205

New residential subdivision gets

Three 600v Durasheath Cables were pulled in ducts throughout development.

underground distribution system

Electric service is provided by 141,000 feet of Anaconda Durasheath Cable

For one of the South's largest new developments, an entire underground distribution system was installed recently.

The cables: 106,000 feet of Anaconda's 4/0, 1/C 600v Durasheath* neoprene-jacketed cable with Anaconda Type ANW network insulation, and 35,000 feet of #2, 1/C 15kv grounded neutral Durasheath with Type AB butyl insulation.

A good choice! Anaconda's special network and high-voltage butyl insulations give you top moisture and heat resistance, excellent overload protection. Type AB butyl insulation, too, has *inherent* resistance to ozone.

Available in all sizes, single and multiple conductor, copper and aluminum, from 600 to 15,000 volts. Want more information? See the Man from Anaconda or your Anaconda distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U.S. Pat. Off. 57300

LIVE BETTER ELECTRICALLY

SEE THE MAN FROM **ANACONDA®**
FOR **DURASHEATH CABLE**

Each reel on special electric-powered rig held 400 feet of Durasheath.

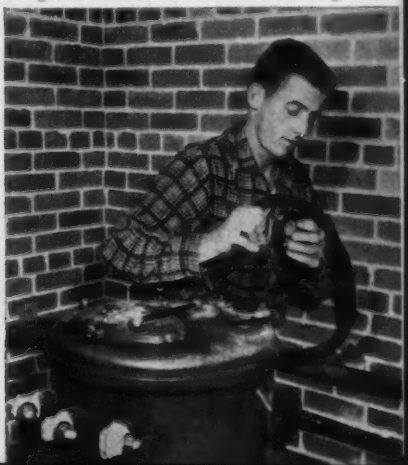
600v Durasheath shown trained through last manhole to side of transformer vault.

15kv Durasheath was likewise pulled into transformer house through duct.

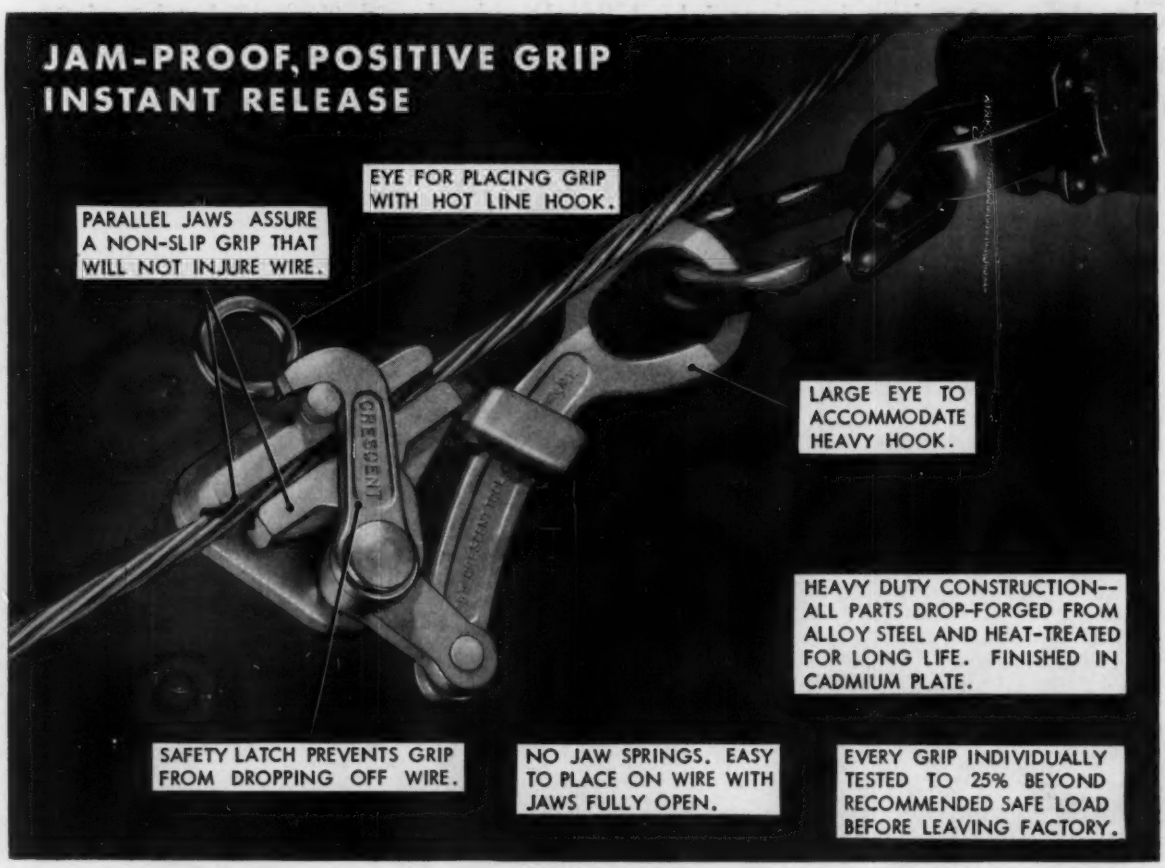
In underground vault of substation, cable was trained to the wall.

In transformer house, 600v Durasheath was terminated at transformer secondaries.

In same location, 15kv Durasheath is shown being terminated at transformer bushings.



CRESCENT WIRE GRIPS


JAM-PROOF, POSITIVE GRIP
INSTANT RELEASE
EYE FOR PLACING GRIP WITH HOT LINE HOOK.
PARALLEL JAWS ASSURE A NON-SLIP GRIP THAT WILL NOT INJURE WIRE.
LARGE EYE TO ACCOMMODATE HEAVY HOOK.
HEAVY DUTY CONSTRUCTION-- ALL PARTS DROP-FORGED FROM ALLOY STEEL AND HEAT-TREATED FOR LONG LIFE. FINISHED IN CADMIUM PLATE.
SAFETY LATCH PREVENTS GRIP FROM DROPPING OFF WIRE.
NO JAW SPRINGS. EASY TO PLACE ON WIRE WITH JAWS FULLY OPEN.
EVERY GRIP INDIVIDUALLY TESTED TO 25% BEYOND RECOMMENDED SAFE LOAD BEFORE LEAVING FACTORY.
CRESCENT

SPECIFICATIONS

Number	*Maximum Capacity*	*Minimum Capacity*	*Safe Load*	*Eye Opening*	*Weight*
383 —Serrated Jaws	5/16 (.3125)" 8 mm.	—5/32 (.156)" 4 mm.	5,000 lbs. (2200 KG)	1-1/8" x 1-11/16"	1-3/4 lbs.
383-2—Same, except with smooth jaws for aluminum wire.					
384 —Serrated Jaws	1/2 (.500)" 12.2 mm.	—1/4 (.250)" 6.5 mm.	7,500 lbs. (3400 KG)	1-1/4" x 1-3/4"	3-5/16 lbs.
384-2—Same, except with smooth jaws for aluminum wire.					
385 —Serrated Jaws	3/4 (.750)" 19 mm.	—3/8 (.375)" 9.5 mm.	10,000 lbs. (4500 KG)	1-1/4" x 1-3/4"	4-7/8 lbs.
385-2—Same, except with smooth jaws for aluminum wire.					
386 —Serrated Jaws	1-1/16 (1.0625)" 27 mm.	—9/16 (.5625)" 14.5 mm.	12,500 lbs. (5600 KG)	1-5/8" x 2-3/8"	9 lbs.
386-2—Same, except with smooth jaws for aluminum wire.					

For bare and insulated wire, use serrated jaw style. For bare aluminum wire only, smooth jaws.

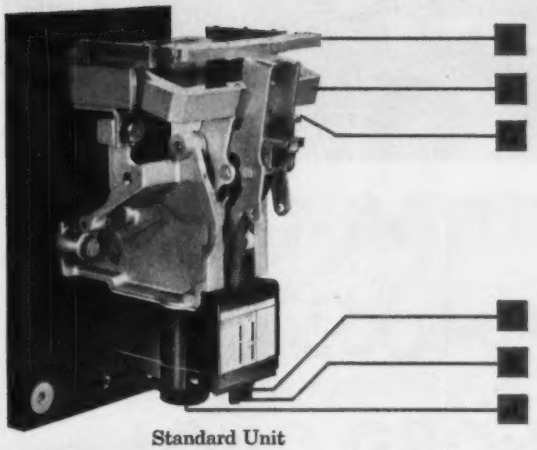
Write for Crescent Catalog No. 28 which illustrates and describes many valuable tools for linemen and other electrical workers.

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

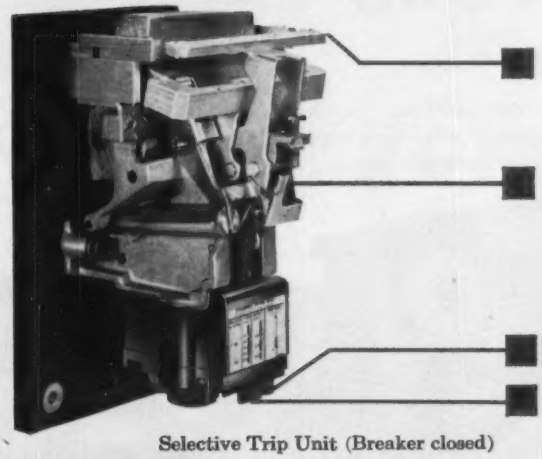
CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

75,000- and 100,000-ampere I. C. breakers with*

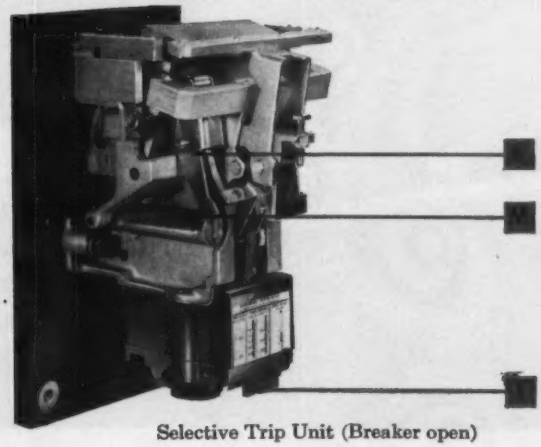
SELECTIVE TRIPPING THAT REALLY SELECTS



Standard Unit



Selective Trip Unit (Breaker closed)



Selective Trip Unit (Breaker open)

True, selective tripping in these DB-75 and DB-100 low-voltage breakers eliminates the necessity that they *ever* close against a fault. The resulting lower closing energy means:

Less mechanical duty on all moving parts.
Less maintenance.
Lower energy drain on electric closing source.

Selective unit returns breaker characteristic to intentional short delay required for selectivity with other breakers, immediately after breaker latches. It does *not* impair the breaker's ability to close against overloads up to ten times the trip unit rating—motor starting, for instance.

All this is accomplished by a simple piston-delayed latch which converts the short-delay trip to instantaneous trip when the breaker is open—and re-establishes the short-delay feature approximately one second after the breaker is latched closed.

Note these features:
Standard trip unit*
***Interrupting capacity 75,000- and 100,000-ampere breakers with**

A. Long-Delay Adjustment
B. Long-Delay Pickup Adjustment
C. Instantaneous Pickup Adjustment
E. Instantaneous Armature
F. Long-Delay Armature
G. Tripping Knob

Only these additions to provide *selectivity with all the above advantages*

A. Long-Delay Adjustment
B. Long-Delay Pickup Adjustment
E. Short-Delay Armature
F. Long-Delay Armature
G. Tripping Knob
I. Short-Delay Pickup Adjustment
J. Short-Delay Time Adjustment
K. Roller Lever
L. Discriminator Latch
M. Reset Spring and Air Piston

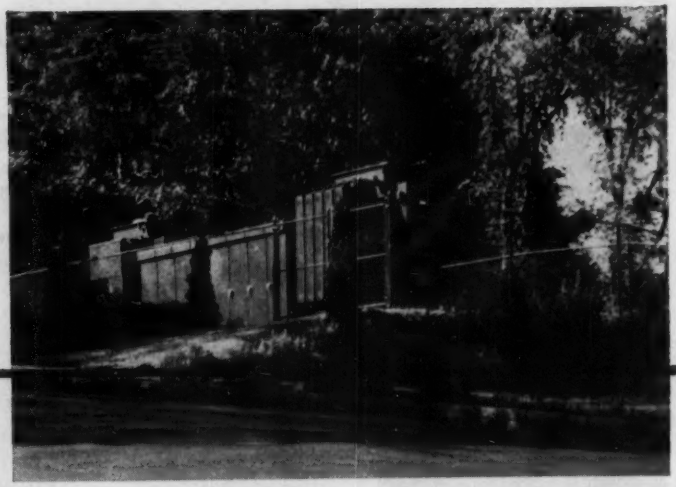
***With standard trip units these breakers are rated 100,000 and 150,000 amperes I. C. at 240 volts a-c.**

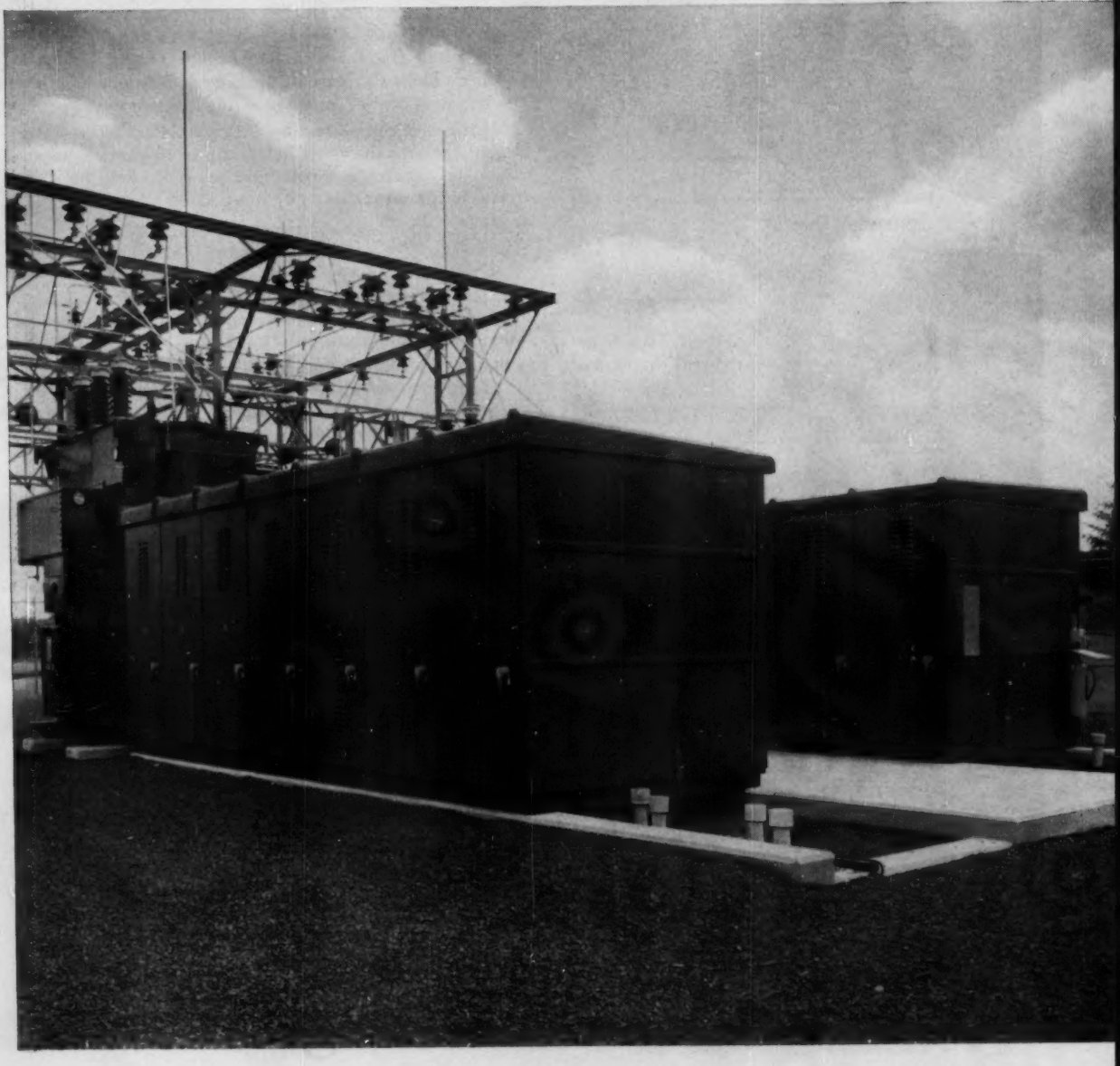
Your nearby Westinghouse sales office has all the details, or you may write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60916

YOU CAN BE SURE...IF IT'S

Westinghouse

Unit substations
designed to grow...
and to be good neighbors





BUILT-IN FLEXIBILITY TO ACCOMMODATE LOAD GROWTH, LOAD SHIFT

Planning for the future—in load growth and load shift—with minimum capital outlay today is a universal distribution problem. Westinghouse anticipated it—designed unit substations that can grow—and be good neighbors in residential areas, too.

For instance:

The box-type throat connection allows simple transformer interchangeability.

Standardized metalclad switchgear makes addition of feeder units economical and visually attractive.

Single-end stations can become double-end with a minimum of installation time and manpower.

Appearance and new low-cost transformer soundproofing make them more acceptable—for less of your money—in thickly populated residential areas.

Moreover, *all* components of Westinghouse unit substations are engineered and coordinated by *one* manufacturer with complete control of design, manufacturing and assembly. Discuss your requirements with your Westinghouse sales representative and learn the full extent of the advantages to be gained. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa., requesting DB 34-250 for additional information. J-60914

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Westinghouse Microwave

MORE RELIABLE —WEATHERPROOF

FR Microwave assures you of vital independence, dependability and growth potential in your control communications.

You are free from weathered-out or flooded-out lines.

Signals are ungarbled by atmospheric conditions—beyond all problem interference at 2000 mc.

Separate, self-contained channel circuits give you greater reliability, fewer outages, simpler maintenance.

Remote station alarm and automatic switch over assure continuity.

You have multiplexing to 30 voice channels, each available for carrying 15 sub-channels of telegraph, teleprinter, telemeter or supervisory control intelligence.

Your system is surveyed, installed, tested—even maintained—by experienced Westinghouse communications engineers.

Your communications are vital enough for you to *own*. Get all the details—and the real low-cost story from your nearby Westinghouse sales office—or from Westinghouse Electric Corporation, Carrier-Microwave Department, Halethorpe, Maryland. J-60907

YOU CAN BE SURE...IF IT'S

Westinghouse

Hell bent for leather

...and going nowhere!

How many contractors today are on this very same treadmill at a time when there's more business around than the industry can properly handle?

Like swimmers battling a tide too strong, they have to keep on hustling just to stay in the same place.

Why? The answer is they're trapped in a vicious circle of cutthroat competition where the harder they scramble, the tighter the profit margins become—until finally, one day, they go out of business.

How To Get Out From Under

Paper and pencil and five minutes of simple arithmetic will uncover these basic economic facts: a slight increase in volume with no increase in overhead means a good increase in profits. Same volume with higher overhead means a sickening drop in profits and eventual bankruptcy.

Moral: learn to "sell up" on jobs to increase volume without overhead.

More and more contractors are slowly but surely discovering that the home rewiring market is made to order for this.

Tired of the lean profits of new construction work, fed up with the bid-peddling that too often turned out to be a losing proposition—these contractors started selling "better electrical living." They found a better rate of profit under less competitive conditions and now they're posting some of the highest profit business on the books.

How To Get Started

Over $10 million in this one year alone is being spent by the industry to promote the modernization market. Here's how you can make this investment pay off in profitable business for you.

Tie in locally with the now-well-known national programs of "HOUSEPOWER" and "LIVE BETTER ... ELECTRICALLY." They'll make your own advertising and promotion work twice as hard for you.

Continue to sell "better electrical living" at every chance you get in every way you can—through trade and civic associations, through friends, employees, relatives.

And, finally learn to sell the pleasure and convenience of electrical living. Use simple terms, avoid technical jargon. Concentrate on the benefits rather than the involved details of the wiring system—and you'll find plenty of high profit business coming your way.

Published in the interests of the Electrical Industry. Reprints of this message are available by writing to Dept. EWC at:

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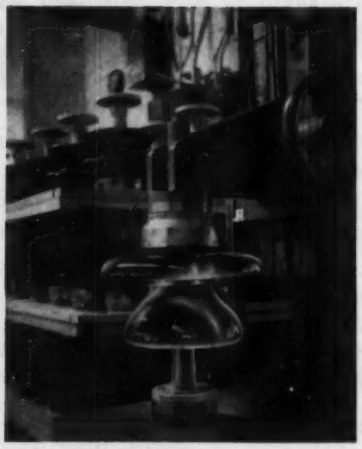
RECOGNIZED RELIABILITY

69KV

NEMA TR16



RECOGNIZED RELIABILITY IS EARNED —

— and maintained only by vigilant adherence to "proven" control procedures that are our STANDARDS in the manufacturing of PORCELAIN PRODUCTS APPARATUS INSULATORS.

Several "STANDARD" procedures are illustrated here.

1. DUAL PURPOSE ASSEMBLY JIGS and CURING UNITS.

Prior to assembly of porcelain shells and hardware components, each assembly jig is checked by a Precision Gauge Block to insure exact height, perfect alignment of cap and base mounting holes - this exactitude guarantees complete interchangeability of apparatus insulators.

After the insulator and hardware components are assembled with Insulator Grade Neat Portland Cement the hoods are lowered into position and a complete curing (steaming) cycle takes place. At no time are the insulators moved until this curing cycle is complete.

2. After the routine Mechanical and Electrical test, each unit is double checked, as shown in the photograph at lower right, for parallelism of cap and pin, hole alignment and designated height requirements.

— this is STANDARD procedure - this is why our insulators enjoy RECOGNIZED RELIABILITY.

PP INC.

Porcelain Products, Inc.

High Voltage Division — Parkersburg, W. Va.

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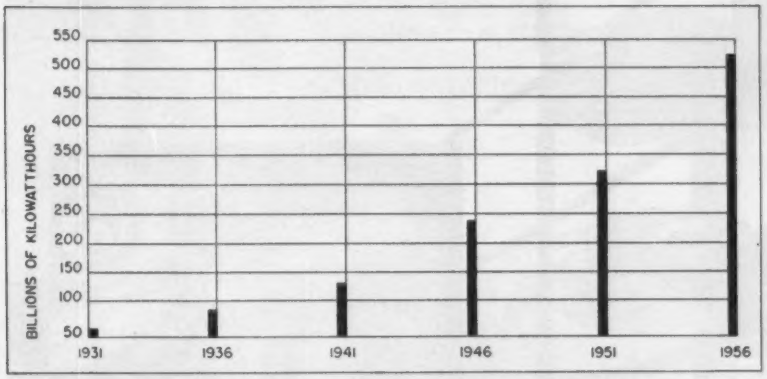
USS COR-TEN Steel Hardware important to expanding utility facilities

- COR-TEN Galvanized Hardware lasts life of treated pole
- Extended service results from excellent corrosion resistance and higher yield point



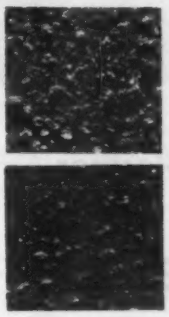
Annual sales of electricity by all utilities, both public and private, to ultimate consumers over the past twenty years. Figures are in billions of kilowatt hours.

Electrical consumption, both industrial and public, has been moving upward in strides that resemble the pace of a giant in seven-league boots. Atomically generated electricity is a reality. New and expanded generating facilities are coming into use all over the country. The eye-bugging *500-billion kilowatt hours* of electricity sold in 1956 looks like a figure reserved for astronomical tabulation. The telephone industry, too, is enjoying phenomenal growth—with new installations running at a rate of 2,000,000 units a year. The growth of these two industries calls for a great deal of transmission-line expansion.

New Lines

In establishing new lines, one important step can be taken that will cut future pole-line maintenance to the bone. That step is the specification of galvanized USS COR-TEN Steel Pole Line Hardware. That's because COR-TEN Steel's excellent resistance to atmospheric corrosion and its greater strength make it an ideal material for pole line application. In a direct comparison with plain carbon steel, COR-TEN Steel shows a *50% higher* yield point plus a resistance to atmospheric corrosion that is *four to six times* that of carbon steel. Here's how this translates into terms of service: in the corrosive atmosphere of industrial and marine areas, plain carbon steel hardware usually must be replaced at least once or twice during the life of a treated pole. Hardware made from COR-TEN Steel, on the other hand, is strong enough and corrosion-resistant enough to withstand the ravages of these atmospheres *for the full life of a treated pole!*

Why It Lasts



Carbon Steel (1.5 years)

Actual photograph of initial coating of rust on uncoated samples of steel.

USS Cor-Ten Steel (1.5 years)

The corrosion rate of galvanized COR-TEN Steel Pole Line Hardware and galvanized carbon steel pole line hardware is found to be about equal until the iron-zinc alloy layer becomes exposed through oxidation of the protective zinc coating or through breaks in the surface due to scratches caused by handling. When these conditions prevail, it is then that the true value of COR-TEN Steel becomes evident. The rate of corrosion of the iron-zinc alloy layer on COR-TEN Steel is considerably lower than on the carbon steel. Further, when the bare metals are exposed, COR-TEN Steel forms a smooth, tightly adhering oxide coating that keeps moisture from penetrating, thus slowing down further corrosion (see cut); while the loose, flaky scale on carbon steel (see cut) drops off, allowing further corrosion to take place.

Higher Yield Point

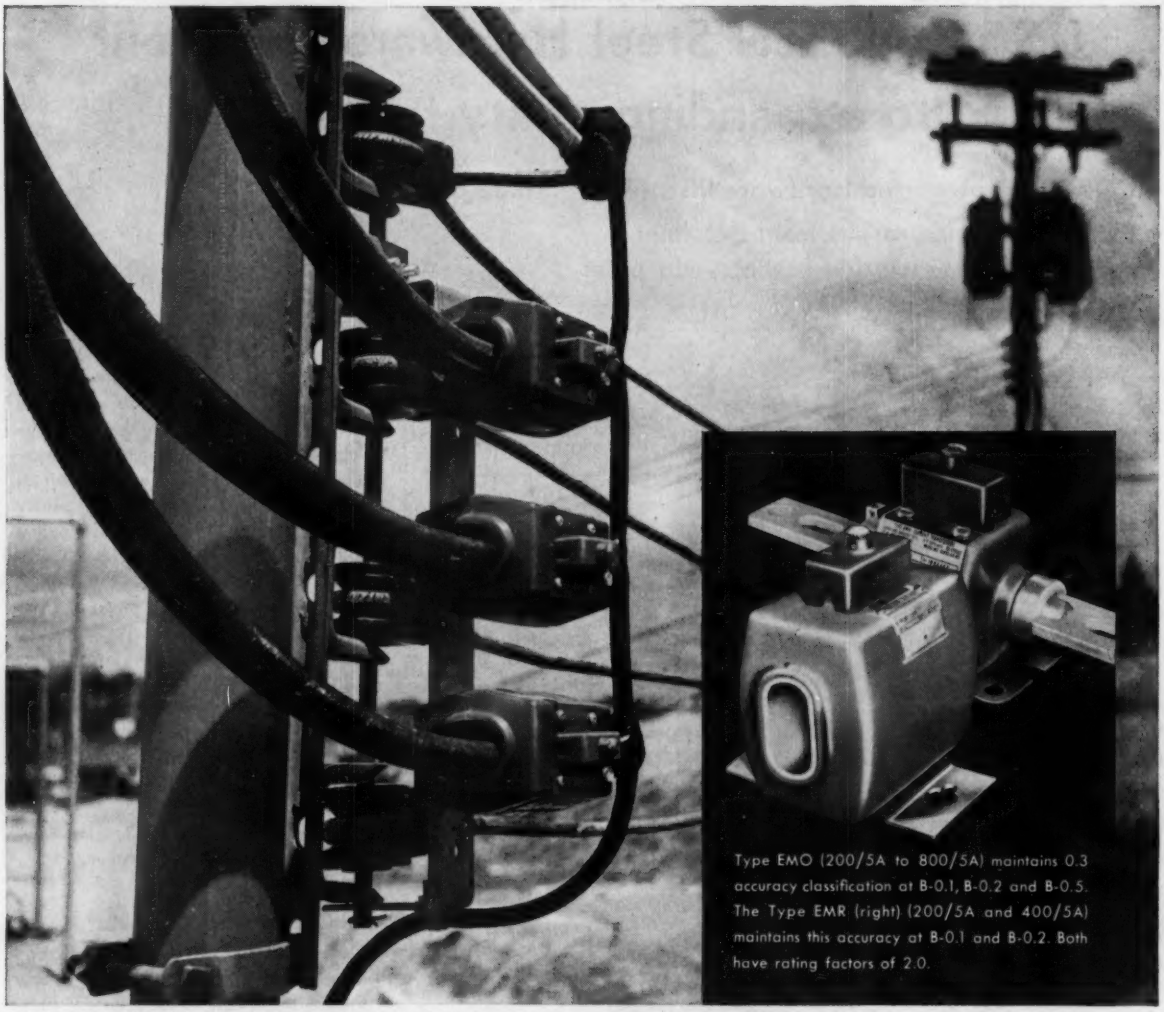
Once deterioration of a steel sets in, the matter of exactly how long it can remain in service depends a great deal on the steel's yield point. This is particularly true of thinner gage hardware such as straps. Here again, COR-TEN Steel stands pole and cross arms above carbon steel. In thicknesses of ½ inch and less, USS COR-TEN Steel has a minimum yield point of 50,000 psi. This means that even when a piece of COR-TEN Steel Hardware corrodes to the point where a unit of carbon steel would have to be replaced, the COR-TEN Steel Hardware is still capable of many more years' active service on your pole. For example—in an industrial atmosphere, an uncoated ⅝-inch COR-TEN Steel bolt can be expected to have a service life of 35.7 years—*five times the life of a carbon steel bolt the same size!*

Simultaneous Replacement

Certainly the most economical method of establishing and maintaining utility lines is to be able to erect a new, pressure-creosoted pole and its hardware and have them both remain in service for an equal time. The savings enjoyed are obvious — no maintenance-crew-time for replacement, no further investment in hardware, no interrupted service, less wear and tear on equipment. That's why serious consideration of USS COR-TEN Steel is so important to your future maintenance costs.

Although United States Steel does not manufacture pole line hardware, it is the major producer of COR-TEN High-Strength Low-Alloy Steel. We will gladly send you the names of companies manufacturing pole line hardware from USS COR-TEN Steel. To help you in making your decision, you'll find a great deal of pertinent information on low-cost, high-strength, corrosion-resistant hardware in our book, "USS COR-TEN Steel Pole Line Hardware." Just write to United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

"USS" and "Cor-Ten" are registered trademarks.



Type EMO (200/5A to 800/5A) maintains 0.3 accuracy classification at B-0.1, B-0.2 and B-0.5. The Type EMR (right) (200/5A and 400/5A) maintains this accuracy at B-0.1 and B-0.2. Both have rating factors of 2.0.

EMO's mounted on TMB-3 Brackets (Patent Pending). Brackets manufactured by B & C Metal Stamping Co., Atlanta, Georgia.

EMO Indoor/Outdoor Metering Transformer . . . 600-Volt Class, 200-800 Amps

50% greater cable capacity

Now molded from a polyester elastomer insulating material, product of Westinghouse research, the Westinghouse Types EMR and EMO current transformers are *five ways superior to any comparable units.*

1. **50% Greater Cable Capacity**—exclusive obround primary opening—the EMO above (200/5A.) handles two 750 MCM cables, 50% more than comparable units. The EMR features a round primary opening, with optional, removable round or flat terminal bar.
2. **Positive, Permanent Cable Connections**—exclusive Ilsco-type secondary terminals (Underwriters' listed) with weatherproof covers provide more positive, permanent connections.
3. **Longer Life**—polyester molding gives outstanding protection against weather, and corrosive acid or alkali fumes. *These transformers are ideal for either indoor or outdoor installation.*
4. **Smaller, Lighter**—polyester molding, plus the new design, has reduced the size and weight of these units, simplifying installation.
5. **Unexcelled Thermal and Dielectric Stability**—physical flexibility is maintained at high and low temperatures.

For full details, call your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70800

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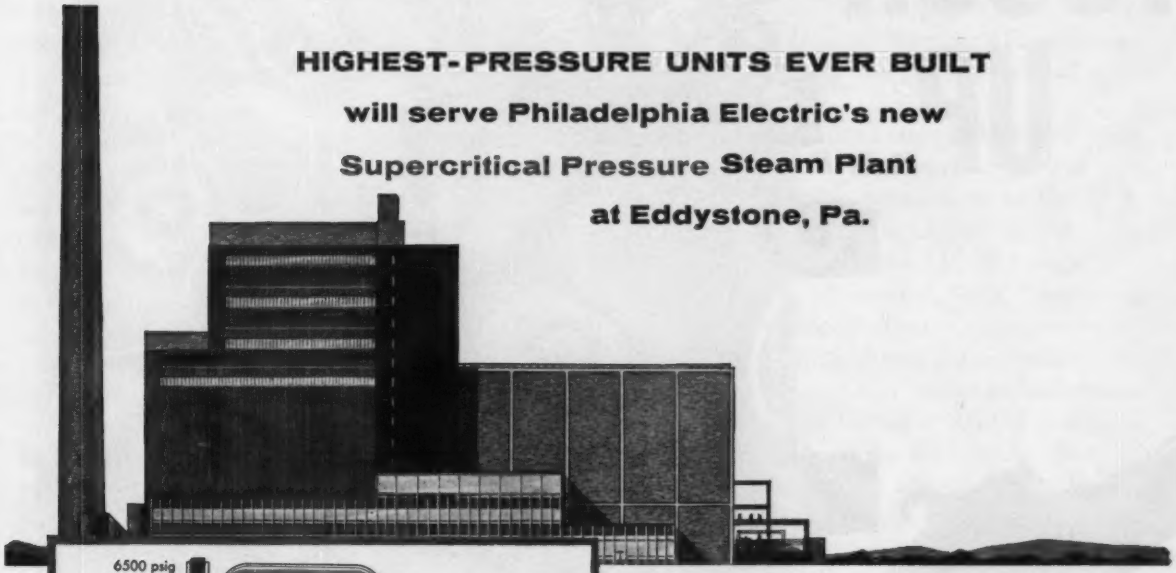
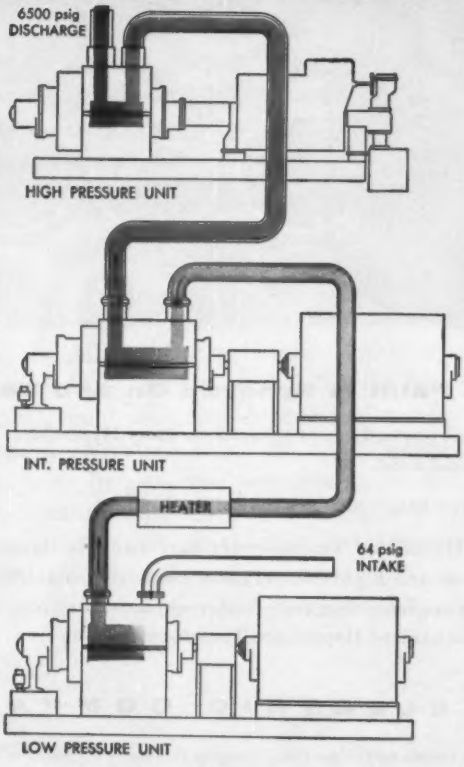
6500 psig
BOILER-FEED PUMPS

HIGHEST-PRESSURE UNITS EVER BUILT
will serve Philadelphia Electric's new
Supercritical Pressure Steam Plant
at Eddystone, Pa.





Feed water at approximately 6500 psig will be provided by six CHTA pumps, operating as two half-capacity pumping units. Each pumping unit will consist of 3 pumps in series as shown above.

SCHEDULED to go on the line in 1959, Philadelphia Electric Company's 325,000 kw Eddystone Station will operate at a higher steam temperature and pressure than any installation thus far announced. Using supercritical pressure and two reheat stages, it will require less fuel per kw-hr than the most efficient power station now in operation.

The steam generator will be served by six Ingersoll-Rand double-case pumps. To provide the required pressure and capacity they will be arranged as two half-capacity pumping units each consisting of three pumps in series. The suction pressure will be 64 psig and the discharge approximately 6500 psig. The final discharge temperature is 575°F. Featuring Ingersoll-Rand's proven *Unit-Type Rotor Assembly*, these pumps will be the highest-pressure boiler feeders ever built. Special stuffing box designs will be used to control leakage at this supercritical pressure.

The selection of I-R pumps for this historic installation reflects the confidence of Philadelphia Electric Company in Ingersoll-Rand's ability to design and build equipment for pressures and temperatures never before encountered in boiler-feed service.

Whatever your boiler-feed requirements, they can be met to advantage with Ingersoll-Rand centrifugal pumps of proved dependability and economy.

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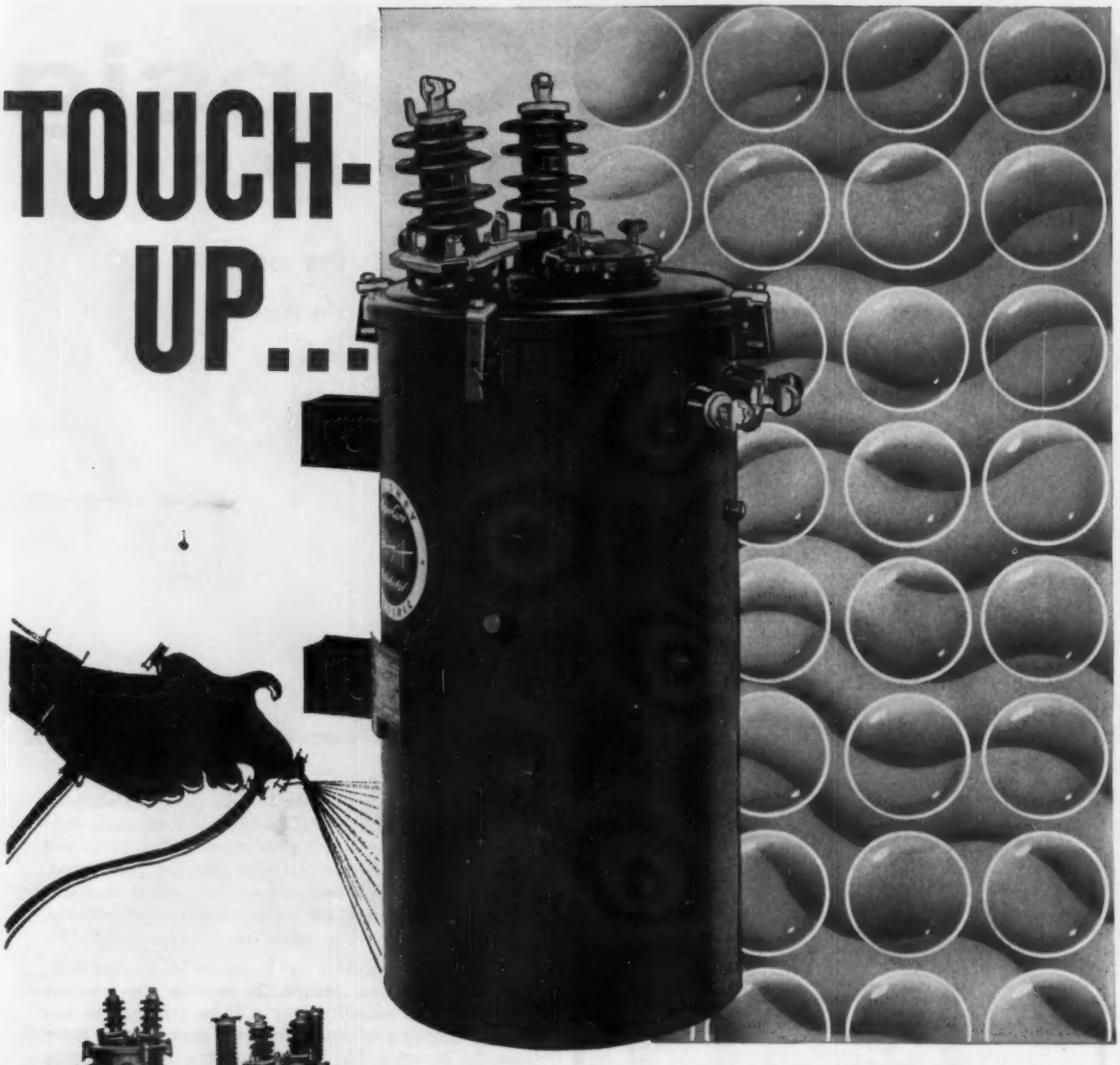
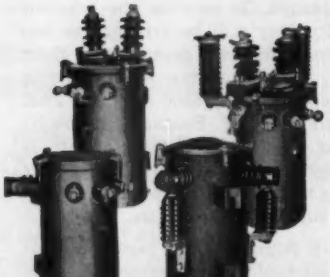
TOUCH-UP...





HyperCore Transformers are available from stock in all Standard Ratings in both Conventional and CSP designs.

MEBB-10

Even Touch-Up Paint Is Sprayed On and Baked

Touch-up paint . . . when required . . . is sprayed on *every* HyperCore Transformer—*just like the original paint.*

It's baked, too, by infra-red heat—just like the original paint.

That's why dependable HyperCore Transformers have consistently uniform and durable surfaces that are highly impervious to weathering. Moloney HyperCore Transformers are *better than ever*—today—because they're products of Moloney's new and mechanized HyperCore Transformer Plant.

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AIEE Board Sets New Policy—Part II

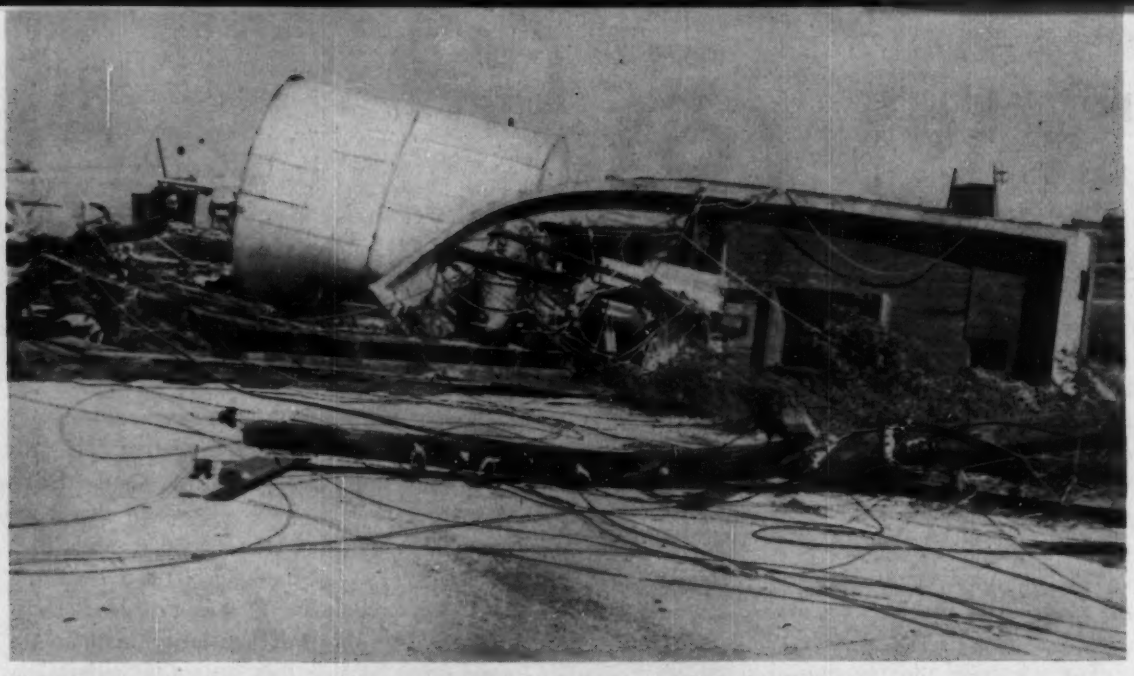
In Part I of this series, appearing in the July 1 issue of Electrical World, we dealt with the first point in the new AIEE policy announced by President Coover in the June issue of *Electrical Engineering*. This first point was that AIEE will limit its activities to the "advancement in technology in all branches of electrical engineering." Activities in the field of professional development and economic status are delegated to the National Society of Professional Engineers.

Now we would like to comment upon the second point relating to the similar limitations to be placed upon the Engineers Joint Council. The policy statement proposed that "The Engineers Joint Council provide the medium for co-ordination and cooperation on technical matters transcending the electrical field, and present to the public the position of the engineering profession on technological matters." Here again we see the careful exclusion of any activity relating to the professional development and economic status of the engineer.

In an interview with Walter Barrett published in the July 8 issue, we asked him how the activities of the Engineers Joint Council would be changed should the AIEE policy be adopted by the other societies. He stated that "in the first place, EJC would limit itself to the coordination of technical activities. This," he said, "would have the immediate effect of permitting a change in its tax status from 501-C-6 to 501-C-3. We would have to transfer to the National Society of Professional Engineers such present EJC activities as the Governmental Activities Committee, the Committee on the Practice of Engineering, and the Engineering Manpower Commission."

Although the heads of other technical societies have not indicated their approval of this proposed move, their representatives on the Engineers Joint Council have moved in the same direction. Activities of the EJC that might prevent a change in tax status to 501-C-3 are being turned down regularly. That is, proposed activities having to do with legislative matters are turned down because they cannot be undertaken by an organization having a 501-C-3 status. A move to incorporate the EJC in the State of New York would be an additional step toward changing the tax status. It would appear therefore that the EJC is already moving in the direction toward which the AIEE Board is leading.

Whether it is entirely by design or default, the National Society of Professional Engineers is being handed a big responsibility. With only a small representation from most professional societies, the responsibility far outweighs their ability to perform. The eyes of the engineering profession will be upon them to see if they can now change their policies so as to provide the flexible and strong leadership that will be essential. The first required step, as pointed out by the AIEE policy statement, is that "NSPE should put itself in a position to represent the profession more completely by expanding its individual membership organization to include those qualified members of the profession whose work does not by law require registration as well as registered engineers."



This Cameron, La., scene bears mute witness to the fact that . . .

Audrey Shows That She's No Lady

Season's first hurricane rips through Gulf States Utilities distribution system, inflicts at least $300,000 damage, kills two clean-up men and 416 others

Gulf States Utilities is revising upward its estimate of the damage wreaked by Hurricane Audrey, which swept in from the Gulf of Mexico and snuffed out the lives of 418 persons in southwest Louisiana. Company officials believe the repair bill will surpass $300,000—the first estimate.

Audrey damaged GSU's system over a wide area, reported President Roy S. Nelson. The hurricane also claimed the life of Gerald Lee Bridges, a 31-year-old line foreman, who was electrocuted while trying to rescue two citizens lying unconscious in a pool of water. Audrey also killed a tree-trimming contractor's employee by inflicting a head injury while he was helping to restore service in Lake Charles.

Four of the five metropolitan areas served by GSU lay in the storm's path. All of the company's service area along the Gulf coast between Beaumont, Texas, and Baton Rouge, La., was hard-hit. Audrey's eye passed a few miles west of Lake Charles in southwest Louisiana, and this city, only 40 miles inland from Cameron where hundreds lost their lives, was hardest hit.

Orange, Port Arthur, and Beaumont—all in southeast Texas—shared the brunt of the storm with the Lake Charles area. Baton Rouge was caught by the eastern edge of the storm, but damage there was not extensive.

Generating stations at Beaumont and Lake Charles kept running despite high winds and high water. Service to hospitals and major industries was restored a few hours after the storm hit Thursday morning (June 27). Service was about normal throughout southeast Texas the following Monday. About half of the 107,000 services were interrupted by the storm in this area.

The Lake Charles Div, with 57,000 customers—50,000 of whom were "blacked out" by the hurricane—had restored service to all but about 2,000 on Monday. But nine small communities east of Lake Charles, served by 69 and 34-kv highlines paralleling Highway 90, were still without service on Monday. For 65 miles the line was leveled. Its 485 sixty-five-foot poles lay sprawled on the highway.

Damage to other highlines in the area was minor and not a real factor in widespread interruptions. Most damage was to distribution systems, often caused by falling trees in heavily wooded residential areas.

Only last November, GSU had revised its "disaster operating procedure." Company officials credited this foresight for the speedy service restorations that followed the storm.

Scope of the plan is suggested by general headings such as Sources of Outside Help, Service Priorities, Guarding Hot Wires, and Public Information. Previous group and safety meeting discussion assured effective participation.

They also credited neighboring utilities for quick volunteer help: Houston Lighting & Power sent four line crews; New Orleans Public Service, three; Louisiana Power & Light and Central Power & Light, two each; and Southwestern Gas & Electric released 16 line contract crews so they could help GSU.

Those were supplemented by ten company crews sent to the stricken area by other GSU divisions, and by employment of six heavy-labor crews and six tree-trimming crews.

Power Bills Tangle in Civil Rights Snarl

The Senate last week plunged headlong into the civil rights issue, leaving in abeyance various bills affecting the power industry.

It promises to be six weeks or more before the Senators return to such matters as the Niagara bill, atomic insurance, and TVA revenue bonds.

There is no predicting what will happen to these measures after the civil rights fight. If it results in further emotional bitterness, the outlook for much of the legislation becomes distinctly cloudy.

The civil rights issue showed up in the case of the Hells Canyon bill which passed the Senate a few weeks ago. The Southern Democrats, who often team with Republicans to give the Administration a majority in backing or opposing measures, voted for Hells Canyon to hit back at the Administration for pushing civil rights.

There was a last-minute flurry in the Senate to obtain action on some of these measures. Senate Democratic Leader Lyndon Johnson (Tex.) told the Senate that Sen William Knowland (R-Calif.) had stated only extremely urgent bills and bills that could be handled by unanimous consent would be permitted to come up during the civil rights debate.

Atomic Insurance Shelved

But when an attempt was made to obtain action on the House-passed atomic liability insurance bill by unanimous consent, one objection consigned it to nonactive status for the duration.

This bill, sponsored by Sen Clinton Anderson (D-N. M.) and Rep Melvin Price (D-Ill.) has Democratic and Republican backing and has been strongly urged by industry.

It establishes a maximum $500 million federal liability for any one reactor incident and covers all reactor licensees, government or private. Purpose is to provide liability insurance above the amount put up by private insurance firms, which is not considered enough for the worst possible accident. Private insurance has offered up to $60 million for both property and liability claims.

Although the bill is relatively noncontroversial, a bitter civil rights fight could see Southern Democrats trying to scuttle the measure out of revenge.

The Niagara bill also failed to squeak through unanimously. Minutes before the civil rights debate began, Sen Robert Kerr (D-Okla.), the bill's sponsor, urged Senate action. Congressional observers, however, wonder what was behind the delay in bringing Niagara to the floor sooner. There was no apparent reason for waiting until the last minute to try for Senate action.

Next: Preference Clause Alliance?

Although the Niagara bill is a compromise, alloting about half the power to preference customers, public power supporters would still like a pure federal preference clause.

Conceivably, Democratic strategy could call for attempts to amend the bill with the support of embittered Southerners by incorporating the preference clause.

Also caught up in the tangle is Kerr's bill to provide revenue bond financing for future TVA power expansion. It allows TVA to issue up to $750 million in revenue bonds.

This bill does not have Administration backing because Congressional controls over TVA are not considered strong enough.

Jones: Ike's Choice for TVA

President Eisenhower again has caught Washington by surprise by nominating a non-controversial figure to a controversial post. He did it first with Floberg and Graham for AEC vacancies. Now he has done it with Arnold R. Jones, 57, little known deputy director of the Budget Bureau, whom he has named as a director for Tennessee Valley Authority. Jones would replace Harry A. Curtis.

A Kansas Republican, Jones is close to Milton Eisenhower, dating to their association at Kansas State College where Milton was president and Jones dean of financial administration.

The TVA vacancy has been one of Eisenhower's more difficult ones to fill. Dozens of names had been considered. Many declined the job, which would come under fire from public and private power interests.

When he finally made his choice Eisenhower didn't consult Kentucky's two Republican Senators, Thruston Morton and Sherman Cooper, on whom he had been leaning heavily for advice in this matter.

However, he did call Morton who subsequently had a quick interview with Jones and reports that he is satisfied the appointment will be a good one for TVA.

If Jones is confirmed, Eisenhower nominees will be in the majority on the three-man TVA board.

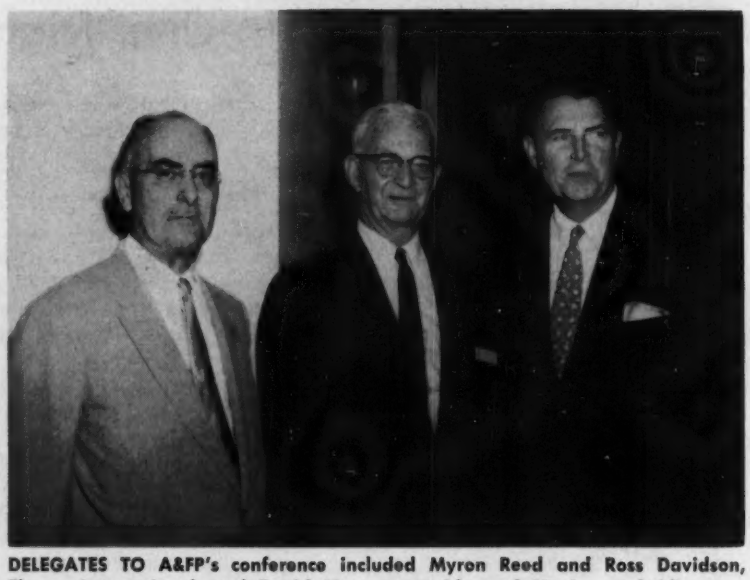
A&FP Hails Political Progress

Nationalists discover they can't generate any cheaper than private companies; big spending program outlined

American & Foreign Power Co says its Latin America outlook has brightened in the past decade, and the company will spend at least $400 million to expand capacity in the next five years.

Myron G. Reed, executive vice president in charge of operations, for Ebasco International Corp, told a recent A&FP international engineering conference in Mexico City that the crest of the "nationalist" wave seems to have passed.

"Politically," he said, "we feel that great progress has been made. During the past decade, several Latin American countries have been suffering from the evils of over-ambitious nationalists advocating government ownership of electric power plants at times when they needed all of their available resources for other public works—such as schools, hospitals, and roads. The crest of this wave seems to have passed, just as it did in the U. S.



DELEGATES TO A&FP's conference included Myron Reed and Ross Davidson, Ebasco International, and David Matson, president of Mexican subsidiary

Private Service "Excellent"

"The former advocates have learned," continued Reed, "that their public power plants cost as much, if not more, than ours—that they cannot produce and sell electricity any cheaper than we can. And although some politicians still like this public power issue as a football, they generally concede that, properly controlled, private industry has done and should continue to do an excellent job in supplying electric service throughout the hemisphere.

"They now realize that it is to the advantage of their countries that we be given reasonable assurance that we can earn a fair rate of return on our invested capital so that we, in turn, may provide them with this service which they so badly need."

Reed also told delegates that the "absolute minimum" construction program A&FP contemplates for the next five years will cost about $400 million. This sum will be used to expand generating capacity in all of A&FP's holdings except Argentina.

"And if all the possible favorable conditions were to materialize—mainly favorable rate adjustments—these desired expenditures would be in the neighborhood of $800 million," he said. "Successive five-year programs might be even larger."

The $400 million is to be spent through A&FP affiliates in Brazil, Chile, Columbia, Costa Rica, Cuba, Ecuador, Guatemala, Mexico, Panama, and Venezuela. A&FP also has Cia. de Electricidad del Sud Argentino in Buenos Aires, Argentina, but is awaiting political and economic developments before committing itself to expenditures there.

The Mexico City meeting initiated A&FP's proposed series of international engineering conferences. This first meeting attracted 56 delegates from 11 Latin American companies, and a 20-man delegation from New York to discuss present engineering problems and future plans.

Lines Boosted to 110 Kv

George S. McLaughlin of Cia. Impulsora de Empresas Electricas, reported experience his company has had in boosting line voltage. He said transmission voltages were jumped from 66 kv to 110 kv without additional insulation on lines running through the semi-desert areas near Torreon. Because of the low humidity and rarity of storms, these lines have been operating successfully for two years now, he said.

After R. M. Nokes, senior relay engineer, New York office, delivered a paper on lightning protection (urging maximum use of special load conditions), the delegates heard the Mexican section describe a specific example.

The conference was opened by Gilberto Loyo, Mexico's secretary of commerce. He welcomed the delegates and said the final result of the engineer's labor must be to provide better service.

It was considered an unusual compliment for Loyo to have addressed the conference because the meeting was sponsored by a "foreign" company and Loyo is board chairman of the Comision Federal de Electricidad, the Mexican government's electric power agency.

Official conference sponsor was the Ebasco International Corp, a wholly owned service subsidiary of A&FP. Host company was Cia. Impulsora de Empresas Electricas, A&FP's Mexican affiliate.

British Call Atom Risks "Insurable"

Committee recommends all claims be against reactor owner; report discusses possible premiums

The risks associated with atomic installations "are insurable," according to a report published in London by the British Insurance (Atomic Energy) Committee.

After examining the subject thoroughly, the committee issued recommendations for a system of insurance covering land-based nuclear power plants. It is believed that the suggestions will be accepted widely.

For third-party insurance—including both property damage and personal injury from radioactive contamination—the report recommends centralization of all claims on the reactor owner. This avoids possible claims against contractors, sub-contractors, and suppliers.

The committee feels material-damage coverage granted to reactor owners should be set up on an annual basis for specified perils only—not for "all risks" subject to detailed exclusion.

Suggested premiums will have no significant effect on the cost of nuclear power, it is believed. The report says a premium of $280,000 would provide coverage of $112-million—$84 million for material damage to each reactor and a further $28 million for liability arising from the use of each reactor. (For possible liability premium costs in the U. S., see EW, April 15, p 68.)

Commented the London Financial Times: "British success in dominating the world's reactor insurance market would create a major new source of invisible income worth at least several hundred million pounds in the years ahead."

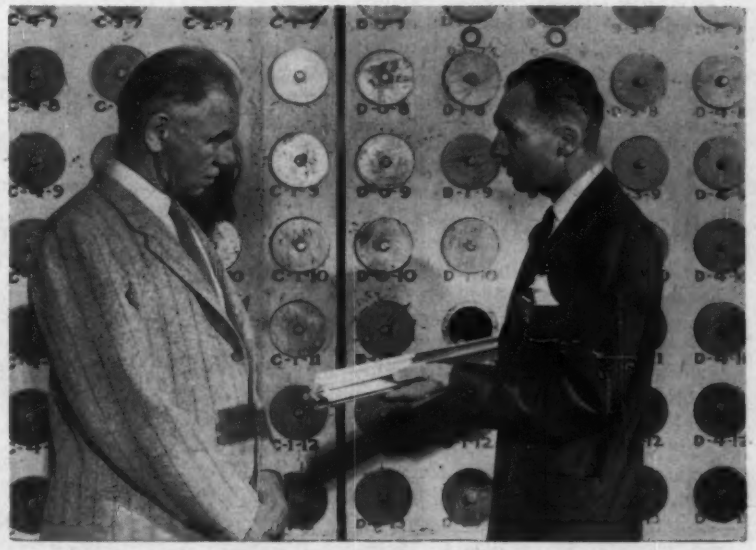
NUCLEAR NOTES

Britain's Prime Minister MacMillan said U. S. firms with AEC "access permits" may now apply for "adequate information" for evaluating the gas-cooled, graphite-moderated nuclear power reactor. He said Calder Hall details would be released "solely for the purpose of work for the Commission."

Atomic energy agencies, designed to promote and support nuclear research and development programs, have been established in ten states so far: Arkansas, Connecticut, Florida, Georgia, Maine, Massachusetts, New Hampshire, Rhode Island, Tennessee, and Washington.

Health and safety measures aimed at protecting workers from possible harm relating to industrial uses of atomic energy have been adopted by several states. In New York, limits on radiation exposure will be cut to 0.3 units a week—one-third the present level—if a recommendation by the National Committee on Radiation Protection and Measurement is accepted.

Industry's reluctance to invest capital in nuclear installations is due to the lack of uniform standards in the field, says Morehead Patterson, president of American Machine & Foundry Co.



Brookhaven to Get New Fuel Elements

Beginning this month, 5,000 new nuclear fuel elements will be delivered to Brookhaven National Laboratory, Upton, N. Y., at the rate of 500 a month for ten months under a $250,000 "refuelling" contract with Sylvania-Corning Nuclear Corp.

The fuel plates are metallurgical sandwiches, their "meat" being a 93% enriched uranium-aluminum alloy encased in aluminum. Each plate is about 2 ft long, 3 in. wide, and $\frac{1}{16}$ in. thick. Each plate is manufactured as a flat sheet, then is shaped into a complex "V," as pictured here. Three such elements are welded to aluminum rings to form a complete 2-ft-long fuel assembly about 2½ in. in diam. A principal benefit expected from the new element is higher neutron flux than that yielded by the old elements—which are 11-ft-long aluminum cans containing 33 natural uranium slugs each 4-in. long and 1.1 in. in diam.

THE NEWS-BEAT

Barge Line Honors Sporn

As a tribute to American Gas & Electric for its work in stimulating economic development of the Ohio River Basin, the American Barge Line recently honored AG&E's president by naming its newest, shiniest towboat "Philip Sporn." The vessel, which appropriately has an all-electric galley, is capable of pulling more than 20,000 tons of cargo. It was finally christened by Mrs. Sporn after six futile swipes with a stubborn bottle of champagne.

In a ceremonial speech, Patrick Calhoun Jr., president of the barge line, pointed out that a close relationship exists between river traffic and the economic development of the region.

Nebraska Weather Watchers

Consumers Public Power District has affiliated its 263 mobile and stationary radio units with Nebraska's Civil Defense weather watchers to provide fast warning of approaching storms and quick cleanup crews when needed. This coordination of facilities means that Nebraskans now have one statewide storm-spotting system that can warn citizens in minutes when weather trouble is headed their way.

Another Step for CL&P

Connecticut Light & Power Co's plan to build an ultra-modern steam plant on Manresa Island—bitterly opposed by nearby residents—appears to be one step nearer reality. The state's Superior Court has upheld the Public Utilities Commission's order permitting CL&P to build the $25-million, 150-Mw, coal-burning station. CL&P states that the plant will meet the architectural restrictions and requirements imposed by the Norwalk Zoning Commission, that 99% of its fly ash will be eliminated by modern equipment, and that its grounds will be carefully landscaped. Target date for operation is October, 1959. The plant site was chosen entirely with respect to supplying load in the southeast corner of Connecticut, the company said.

"Brain Core" Arrives

Pacific Power & Light Co has received in Portland the "brain core" of its $1-million electronic Datatron computing system which is slated to become a "work horse" in solving complex problems. PP&L already has applied a similar system, one installed in Seattle, to figuring optimum operating rule-curves for two hydro plants on the Lewis River. It ran similar curves which also encompass the as-yet-unfinished Swift project. PP&L hopes to start experimental billing for a small district in July, and to get its metropolitan Portland billing on an electronic footing by early fall.

Impact of Cool Air

The sudden shift from extremely hot to unseasonably cool weather during the July 1 week end in New York City brought Consolidated Edison Co of New York, Inc., the sharpest drop in daily one-hour peaks ever encountered—813,000 kw. Swings in air conditioning load in New York formerly have been about 500,000 kw.

Con Edison's 1957 system peak to date occurred Wednesday June 26, amounting to 3,460,000 kw. It is the highest system peak on record. When cool air invaded the muggy metropolis during the week end, system load dropped to 2,647,000 kw on Tuesday, July 2. This decrease, however, was compounded by the annual shutdown of New York's garment industry in mid-town Manhattan.

A Load Grows in Jamaica

The little island of Jamaica, lying south of Cuba, generated 149 million kwhr in 1956 and anticipates a 1966 output of 455 million to 850 million kwhr, according to an economic survey prepared for the Ministry of Trade and Industry by Ivan Bloch & Associates. The report shows that Jamaica's kilowatt-hour consumption is growing between 12% and 16% a year. In contrast, growth of kilowatt-hour consumption in the United States averaged about 17% a year during the last ten. But forecasters predict the figure will drop to about 11% a year for the next decade.

Of Snakes and Eagles . . .

Community Public Service Co of Ft. Worth, Texas, reports a 1-hr, 15-min outage at a substation near Johntown caused by a 5-ft water moccasin. Apparently driven from his hole by recent floods, the snake climbed the substation's steel, shorted a 22-kv line, burst insulators, and blew a fuse on the substation's 66-kv feeder. Despite his electrical adventure, the snake survived—until linemen came to restore service. Damage ran about $500.

H. P. Hall, manager of Cherryland Rural Electric Cooperative Assn, Traverse City, Mich., reports an "enterprising eagle" was spotted recently building his nest atop a 65-kv transmission line pole feeding Leelanau County. By the time the bird's project was discovered, the nest contained large sticks and barbed-wire scraps—one of which dangled dangerously near the line.

At APPA convention, the theme was . . .

"More Power at Lower Cost"

- **APPA Gen. Manager Alex Radin sets objectives for year ahead**
- **Group backs use of revenue bonds for financing Pacific Northwest projects**
- **Also urges Congress to repeal fast tax writeoffs for utilities**
- **Panel discussions cover public relations, atomic power, house heat**

In his report to the 14th annual American Public Power Association convention, APPA General Manager Alex Radin sketched in these legislative objectives for the year ahead:

- Continue all efforts for full and comprehensive development of the nation's water resources, especially such projects as Hells Canyon and Niagara.
- Fight any and every attempt to dilute the federal preference clause which gives priority to public bodies and cooperatives in the purchase of federally produced power.
- Continue to press for a workable revenue bond financing plan for Tennessee Valley Authority.
- Support Congressional investigations of rapid amortization and liberalized depreciation provisions of the tax laws and the applications of these provisions by privately owned utilities.
- Encourage Congressional investigation of electric company advertising expenditures.
- Explore new techniques and procedures for broader electrical integration of the nation's publicly and cooperatively owned electric systems.

Other speakers including APPA President William S. Peterson, Los Angeles Dept of Water & Power, indicated general approval of these objectives. Resolutions passed by the Association during the meeting in New York June 25-27 spelled out some of the specifics for attaining these goals.

In fact the resolutions often went beyond the goals discussed by Radin. For not only did the delegates unanimously approve bond financing for TVA, but they endorsed the bond financing principle for possible use in the Pacific Northwest where public power groups propose that Bonneville Power Administration be changed into a "Columbia River Development Corporation."

The Association as a group also voted to urge Congress to take on an extensive investigation of electric company advertising expenditures, after charging that the advertising is "designed for the sole purpose of strengthening the monopolistic position of the private power companies."

Also the Association voted to urge Congress to repeal the rapid amortization and liberalized depreciation provisions of existing tax bills as they apply to electric companies. Any benefits which accrue to electric utilities, said the Association, should be immediately passed on to customers.

The Association passed other resolutions which called for favorable House action on a federal Hells Canyon bill, legislation which would retain the federal preference clause in any power development at Niagara, federal construction of the power features of the Trinity River development in California, federal development

NEW OFFICERS are Owen Hurd, president; S. T. Anderson, first vice president; Mark Whitaker, executive vp

OUTGOING PRESIDENT William S. Peterson confers with Alex Radin, general manager of APPA, during board meeting

of the John Day project in Oregon, federal development of atomic power plants in addition to the present power demonstration program, federal development of the Potomac River basin above Washington, D. C.

In his address to the convention, President Peterson hit hard at electric company advertising:

"All of us are concerned with the continuing barrage of propaganda fostered by over 100 of the privately owned electric power utilities for the purpose of undermining and ultimately putting out of business all forms of publicly owned electric power utilities.

"This challenge to our existence must not go unrecognized and our efforts must be enlarged to counteract such propaganda with the true facts under which it will be understood that the preservation of free competitive enterprise in the natural monopoly field of utility service can only be maintained through the competition that may be found in the comparisons of rates as set by the privately and publicly owned utilities."

Jackson Says Electric Companies Favored

From Washington, where its headquarters are located, APPA brought up some big guns to level at chosen targets.

Sen Henry M. Jackson (D-Wash.) aimed his remarks at the present atomic power development program, charging that it "favors subsidies to private groups," and "discourages the construction of publicly owned and financed large-scale experimental reactors."

As an alternative, he urged that Congress direct and authorize the AEC to contract for the construction of large experimental plants, of various designs, at existing laboratories or installations of the AEC or its contractors."

From Washington, too, came Rep. Clair Engle (D-Calif.) to charge that the partnership power policy of the Eisenhower Administration means "giving away the nation's resources for the profit and benefit of private utilities. He singled out the proposed partnership development of the Trinity River in his home state, declaring it would "prohibit, at least for half a century, any further expansion of federal power in California."

"Partnership . . . is not the answer to development of our water resources—at least not as it is interpreted and practiced by the present Administration," Engle said.

Also from Washington, Clay L. Cochran, director, legislation and research department, National Rural Electric Cooperative Association, devoted his address to a discussion of subsidies. He charged that rapid tax amortization and liberalized depreciation were, in effect, subsidies enjoyed by electric companies.

"People who live in subsidized glass houses." said Cochran, "should not throw propaganda rocks. The power companies, however, have ignored that axiom with a consistency second only to the regularity of their insistence on a guaranteed profit of at least 6% net. Their two favorite dirty words to hurl at the federal power program and the non-profit publics and co-ops that have attempted to bring a measure of competition back into the electric utility industry have been 'socialist' and 'subsidized.'"

"But the facts show," Cochran continued, "that the loudest name-callers have been the biggest recipients of subsidy—and of a subsidy which doesn't fit anyone's standards of desirable or necessary. Little wonder that they have done their best to keep the facts under the rug."

House Heating Should Improve Load Curve

Besides the general sessions, the three-day conference featured several panels on management and technical problems.

S. R. Finley, general superintendent, Electric Power Board, Chattanooga, who chaired the panel on electric house heating, told his audience:

"The electric heating load provides the greatest financial return to the utility when this load can be used to improve system load characteristics."

Finley expects electric heat to have little effect on a system's annual load factor when its saturation is below 15%. He wants it treated as merely another part of the ever-increasing residential load. Demands, he feels, are no worse than with many present appliances.

V. M. Cleaveland, Manager, Clark County Public Utility District, reported that his utility is considering the use of heat pumps to air condition new schools, many of which have large glass areas. He said water-

PUBLIC RELATIONS WORKSHOP: Owen Hurd at rostrum. Seated left to right are Samuel Friedman, Howard M. Down, William Hooper, Ken Billington, and John E. Curtiss, representing the various publicly owned utilities

source heat pumps have proved most successful for providing heat in his area. The Clark County PUD spends 1.5 to 2% of gross revenue for promotion.

A highbrow discussion of the fundamental problems of fusion power was featured in the panel discussion of nuclear power. Norman W. Mather, assistant director of Project Matterhorn at Princeton University, said one of the main problems was confining the area of the fusion reaction. He indicated that an electromagnetic field, rather than material walls, may be the answer to such confinement.

PUD Combats "Divide and Conquer"

After the Stevens County Public Utility District sold out to Washington Water Power Co., the state PUD association set up a special committee to combat a "divide and conquer" move by enemies of public power, said Owen W. Hurd, Benton County PUD manager. The committee's analysis showed the need for uniform action at local district levels, Hurd told a public relations workshop. Other needs: Disseminating PUD facts in areas served by power companies; informing legislative bodies; and improving press, radio, and TV contacts at the state level.

The task force prepared a "PR for PUD" manual that has received enthusiasm of public agencies throughout the U.S., Hurd said. The book details methods of improving communications and dealings with employees, news editors, and legislators. To follow through on the committee's overall recommendations, the state association's budget was upped 40%.

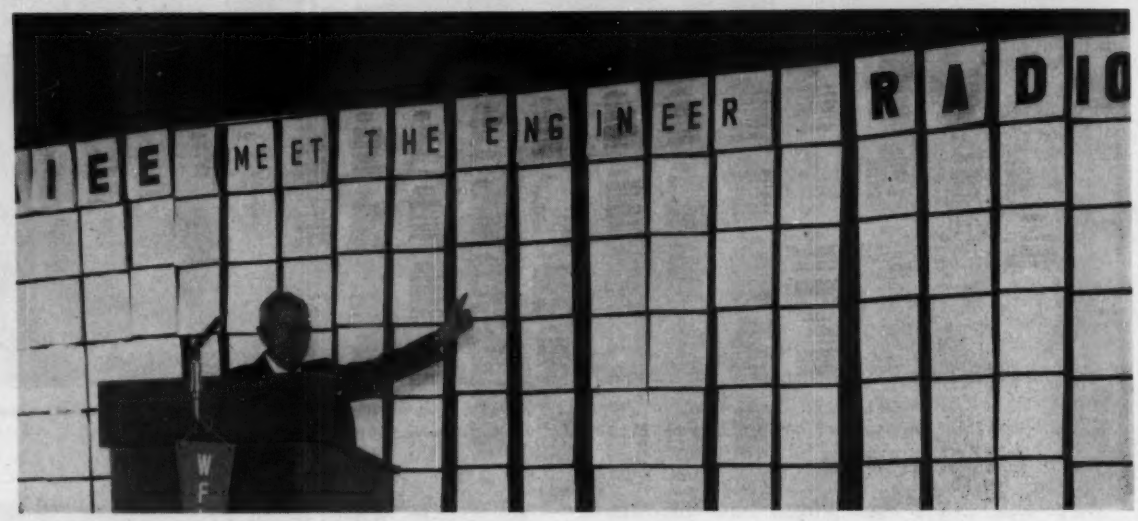
Utilities need both the person-to-person approach and mass communications to achieve public understanding, cooperation, and support, said Samuel L. Friedman, director of public relations, Los Angeles Dept of Water & Power. Emphasis on facts rather than personalities will help squelch the suspicion that the public agency's actions or comments are politically inspired, he said.

"The press considers that it has a right to make your business its business," Friedman said in advising intelligent cooperation with newspapers. He recommended honest, impartial dealings with media representatives and objectivity, even during controversial developments.

HOUSE HEAT: V. M. Cleaveland and S. R. Finley listen

DEAN WISLEDER reports growth of electric space heating

NORMAN W. MATHER discusses problems of fusion power



Told Pooling Reduces Reserve Need

AIEE at Montreal hears collective operation of Texas systems cuts total requirements 190 Mw; capacitor has edge for voltage control

PRES M. S. COOVER and Pres-elect W. J. Barrett review the program of the summer meeting with Chairman F. L. Lawton

Operating contiguous utility systems collectively reduces total reserve requirements, the American Institute of Electrical Engineers was told at its summer general meeting June 24-28 at Montreal, Canada.

Operating five utility systems in south Texas as a pool, rather than individually, cuts total requirements from 520 to 230 Mw, said A. P. Jones, Central Power & Light Co, and A. C. Mierow, Central & South West Operating Committee. The five systems are: Houston Lighting & Power Co, Central Power & Light Co, San Antonio City Public Service Board, Lower Colorado River Authority of Texas, and the Austin Municipal System.

The authors indicated that probability methods were used in establishing the economic justification of providing interconnecting facilities. A probability of .000555 was taken as a criterion for reserve planning. This amounts actually to anticipating an equipment outage resulting in load curtailment about one day every seven years.

On the basis of the investigation, it was decided to close a 138-kv loop around the system by building a 138-kv line between Houston Lighting & Power and Central Power & Light. When this line is completed an annual saving to the system as a whole of about $4 million will be available.

System engineering sessions also discussed multi-purpose switched capacitors and the planning of an underwater cable tie in British Columbia.

For system voltage control, except at interconnection points, multi-purpose, switched capacitors serve the public more economically than voltage regulators. This is true regardless of the power factor at which new loads are added to the system. W. S. Ku, Public Service Electric & Gas Co, came to this conclusion in a mathematical analysis of the needs of system voltage control.

Among the assumptions Ku made are:

1. All substation transformers have the same rating and impedance.

2. All substation buses are solid.

3. A distribution substation is supplied from only one transmission substation.

4. No diversity is considered between loads on the feeder in a distribution substation.

Disconnecting a faulted phase on a single line-to-ground fault, and switching in a spare conductor was

Estimated Savings in Investments and Annual Charges with South Texas 138-kv Loop Closed

	HLP	CPL	CPSB	LCRA	Austin	Saving from Load Diversity Between Systems	Total Saving
Kilowatt benefit	127,000	54,000	64,000	28,000	15,000	46,000	336,000
Est capacity cost per kw*	$95	$110	$121	$125	$130	$100	–
Investment savings	12,065,000	5,940,000	7,744,000	3,500,000	1,950,000	4,600,000	
Additional facilities rqd to realize saving from pool type operation							
138-kv line HLP-CPL	450,000	375,000					
Substation	290,000	290,000					
Net investment saving	11,325,000	5,275,000	7,744,000	3,500,000	1,950,000	4,600,000	34,394,000
Saving in fixed charges	1,472,000	685,750	619,520	280,000	185,250	460,000	3,702,520
Saving in O&M costs	254,000	108,000	128,000	56,000	41,250	92,000	679,250
Annual saving	1,726,000	793,750	747,520	336,000	226,500	552,000	4,381,770

Annual costs*
Fixed charges
Privately owned companies 13%
Publicly owned companies 8%
Estimated operation & maintenance costs
66 Mw and above $2.00
Below 66 Mw 2.75

HLP – Houston Lighting & Power Co
CPL – Central Power & Light Co
CPSB – San Antonio City Public Service Board
LCRA – Lower Colorado River Authority of Texas
Austin – City of Austin

*These figures are for purposes of this example and do not reflect actual costs.

one of the most interesting aspect of the control scheme of the 132-kv underwater cable tie between Vancouver Island and the British Columbia mainland. In addition to this aspect, the relaying required to keep the island's generating system in step with the mainland system under fault conditions on the cable tie was described by S. B. Wilkinson, Canadian Westinghouse Co Ltd, and A. Rohrmayer, British Columbia Engineering Co.

When a single line-to-ground fault occurs, ground impedance relays at one of the cable terminal points provide the initiating impulse to open a disconnect switch on the faulted phase and close another on the spare conductor. Single-pole breakers were not used because of increased cost and decreased reliability.

Costs Favor DC Over AC Bulk Transmissions

Cost comparisons of ac and dc transmission systems dominated discussion in transmission sessions, reflecting the sharp upturn of interest in dc transmission in the U. S. and Canada, particularly for hauling bulk power into downtown areas of metropolitan centers. In a sequel to his 1953 paper, J. G. Holm, consulting engineer, examined the economics of dc transmission today. He found:

1. The economic incentive favoring dc is greatest when power blocks exceed 150 Mw and distances 125 miles, and transmission overhead.

2. Although underground cable is the logical means for transmitting dc because of operating safety and ease of installation, it is more expensive.

3. Irrespective of the power transmitted, the cost of some dc system components cannot go below a minimum. Hence distance has a greater effect on economics of dc transmission than the block of power.

4. Single-conductor, ground-return systems are cheaper than two-conductor, midpoint grounded systems when the ratio of dc to ac operating voltage to ground is 3.0 for both. But when this ratio is 6.0 for the two-conductor system the cost is less than for a single-conductor ground return designed for a ratio of 3.0.

C. S. Schifreen, Philadelphia Electric, observed that dc transmission in the U. S. is more a matter of right-of-way width and availability than of distance. He revealed that his company plans to build a miniature line, to study dc transmission and rectifier transformers.

Lightning performance of 345-kv lines on the American G&E and Ohio Valley Electric transmission systems has revealed fallacies in accepted theories and led to more effective protection, H. L. Rorden, E. S. Zobel, and G. D. Lippert of AG&E reported. Revisions under study involve use of two ground wires, lower towers, and short spaced insulators.

Double ground wires should increase coupling to

conductors, thereby reducing potential across the top insulators, they said. Tower height could be more important than the capacitive coupling obtained with the additional ground wire if a tower is an inductance to a lightning stroke. Shorter spaced insulators, or an equivalent revision in proportions, may give better balanced design for the lightning voltages that occur in service.

Recent tests at Tidd experiment station were aimed at obtaining radio influence characteristics of bundled conductors consisting of two, three, and four sub-conductors. Results were reported by G. D. Lippert and S. C. Bartlett, American G&E Service Corp, along with W. E. Pakala and B. J. Sparlin of Westinghouse Electric. Based on limited comparisons from test data, no fixed relation between RI and corona loss was found. Tests showed that a two-conductor bundle produces the lowest RI and corona loss in fair weather and foul of all conductor assemblies tested, provided conductor potential gradients were the same. Moreover, spacing between sub-conductors of a bundle affected RI in the expected manner.

B. L. Lloyd, Westinghouse, and Otto Naef, AG&E Service, reported corona loss measurements on bundled conductors at Tidd. Good correlation was found between field and lab tests of corona loss during rain. Fair weather measurements on the two-conductor bundle were consistent with previous data. Comparison with single conductor favors the bundle during foul weather, rendering corona loss on 2 x 0.92-in. stranded conductors comparable with a 1.65-in. HH conductor. But during fair weather the HH conductor can be operated at about 17% higher voltage than the bundle.

Test work on miniature conductors was reported by P. D. Tuttle, Alcoa, W. E. Pakala, Westinghouse, and H. L. Rorden, AG&E Service. Some effects may shed light on corona and RI behavior. For example, they found:

1. Corona discharges during the positive half cycle produce more radio influence voltage (RIV) than those during the negative half cycle.

2. Copious discharge during the negative half cycle inhibits the tendency for discharges during the positive half cycle. Treatments increasing the susceptibility to negative discharge may cause RIV levels below the theoretical critical voltage point.

3. Insulating coatings behave very poorly once discharge begins.

4. Surface treatments that proved most efficacious were (a) of a high resistance conducting nature and (b) those resulting in an immense multiplication of possible discharge points. Both lowered the corona threshold voltage, and the RIV level was not as high as for clean-surface samples.

Tailoring selection of steel strands of ACSR conductor to structural requirements of transmission design provide an often overlooked opportunity for cost saving. P. G. Malburg, of Aluminum Co of Canada, pointed out that steel is the variable reinforcing element. Aluminum, he said, is largely predetermined by electrical considerations. Savings up to 3% of capital cost of a line are possible by careful selection of steel stranding and tailoring sag and tension to structure design.

One commentator confirmed savings of $1,000 per mile on a St. Lawrence Power Development line where 1,360.8 MCM 42/7 ACSR was substituted for 1,272 MCM 54/19 ACSR. Another reported a $1,200 per mile saving by Shawinigan W&P on a 230-Kv line through selection of 42/7 instead of 54/19 stranding for a 1,113 MCM line.

Computer Supplants Analyzer

A digital computer of the 650 type has supplanted the network analyzer in solving short-circuit problems on the Bonneville Power Administration system, Martin J. Lantz reported. Digital solution proved more rapid and accurate, he said. Moreover, data preparation time is less as an engineer is not needed to run the study once data are prepared. Additional fault data are readily available after the study has been completed, he said, and the digital method is flexible and completely automatic. His paper described digital short-circuit solution of power system networks involving mutual impedance.

Air-blast circuit breakers are sensitive to high rates of voltage recovery, said W. F. Skeats, C. H. Titus, and W. R. Wilson, all of General Electric. Adding a paralleling resistor and break on the fault side of such breakers often controls the recovery voltage transient economically. Fault duties have been boosted considerably by recent growth in system capacity, he added, observing that faults a few miles out on transmission lines impose a high-frequency oscillation on the line terminal of a breaker which can aggravate voltage rise across its contacts. Recovery rates usually do not exceed 1,000 v per microsecond but may reach 10,000 v per microsecond near large generating stations, he said.

Electrode systems in compressed air breakers must be proved by test in the light of today's limited knowledge of breakdown in compressed air, said L. D. McConnelly, Canadian Westinghouse. But field form is more important than electrode spacing in determining insulation strength. Tests show a greater gain from doubling electrode radius than from doubling the gap, but impulse strengths sometimes fail to maintain the expected margin over 60-cps strength.

Sulfur hexafluoride is a better dielectric than air at the same pressure and can interrupt as severe a fault as compressed air, said W. M. Leeds, T. E. Browne Jr., and A. P. Strom, all of Westinghouse Electric. But the high cost and need to dispose of discharged SF_6 make a closed system more suitable for its use. Its interrupting ability is enhanced by a little understood ability to capture free electrons from the arc path to form relatively immobile negative ions. This phenomenon is believed to contribute to the ability of contacts in SF_6 to interrupt 100 times the current they can in air with very little consumption of the gas, they said.

Formation of bubbles in the oil of a completely sealed transformer is eliminated by a new form of expansion cell, said W. J. Degnan, G. G. Doucette Jr., and R. J. Ringlee, all of General Electric. Key to their solution is an expansion chamber resembling a conservator but

incorporating a synthetic Buna-N-rubber-and-Nylon flexible membrane between the oil and the air. With the oil thus permitted to expand and contract without imposing pressure cycles on entrapped gas to "pump" it into the oil, air cannot be absorbed to emerge subsequently as bubbles. Similar benefits could be achieved in the conventional nitrogen-seal unit if controls are set to hold gas pressure within a ½-to-2-psi range, but gas usage would be boosted considerably, they said.

At the present state of the knowledge an inexpensive reduction of hum level within a transformer of more than 6 db below the NEMA standard is not possible. Therefore treatment of the problem by the use of expensive external barriers is necessary.

But Hydro-Electric Power Commission of Ontario, according to A. T. Edwards, has made progress in obtaining inexpensive wall construction which combines high absorption and transmission loss. For example, an inexpensive and simple method of achieving high absorption with concrete blocks is to drill a small hole into each of the cells within the blocks, thus forming a series of Helmholtz resonators, each tuned to 120 cps.

He said that placing transformer radiators and coolers outside the enclosure gives a much simplified ventilating system, a smaller enclosure, and, consequently, a less expensive acoustic treatment. Of course any piping associated with the cooler system must have connectors flexible in all directions.

Discuss Pipe-Type Cable Rating, Construction

Problems of rating and construction of the many pipe-type cables newly installed in this country were discussed at the insulated-conductor sessions.

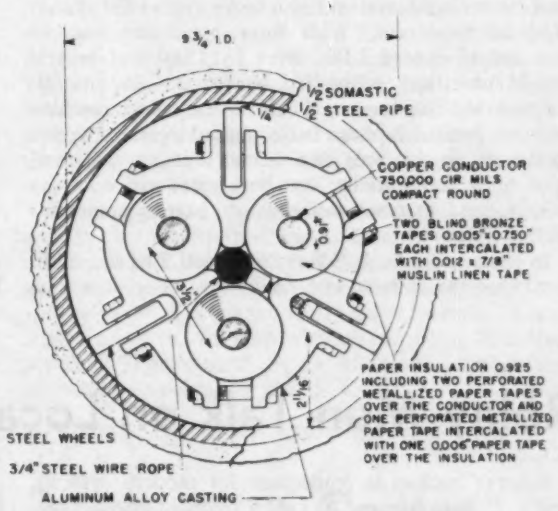
Advent of pipe-type cable has emphasized the desirability of a more rational method of calculating cable performance in duct to obtain a realistic comparison with pipe-type cable. J. H. Neher, Philadelphia Electric, and M. H. McGrath, General Cable, discussed the basic principles involved. They also discussed recently developed procedures for handling the effect of the loading cycle and temperature rise in duct structures.

Solutions to thermal and mechanical problems on 17-mile 138-kv pipe cable installed by Public Service E&G to link Linden station with the system were analyzed by A. S. Brookes and T. E. Starrs. The summer 225-Mva carrying capacity at 100% pf required in this single cable contrasts with the 190 Mva often assumed to be the allowable maximum. To achieve it the cable's conductors were triangulated to reduce pipe losses and the pipe was backfilled with graded quartz to reduce thermal resistance. Automatic oscillation of pipe oil over a limited distance was found practicable and offers a way to cool potential hot spots.

Roller cradles clamped to each phase conductor and pulled by a central steel cable were proposed by R. J. Mather, F. J. McCanna, and E. Demirjian, all of Bonneville Power Administration, as an aid to installing pipe cable for submarine crossings of several miles at depths to 700 ft. For these rollers, 10-ft spacing was selected, after tests showed that 8 to 10 ft caused the least disturbance of the paper insulation during pulling and from simulated load cycles. The roller carriages are attached during cable installation while the cable moves 10 ft per min under 700-lb copper tension. Pre-filling the pipe with oil eased cable pulling by providing buoyancy equal to a third of the weight.

Other tests reported included 6,700-amp faults to the pipe for 6 cycles which cratered the steel to a maximum of 0.342 in. without dangerous boost in oil pressure. Current loading to its rated 630 amp per phase produced temperature gradients of 21C in the paper, 5.5C in the oil, 2.0C in the pipe covering, and 2.0C in free-flowing water to 18C in mud.

Electricite de France has adopted pipe-type cable



for extension of its 225-kv system into congested areas, reported R. A. Tellier. The most recent installation is 1.37 miles of high-pressure, gas-compression construction. But high-pressure, oil-filled pipe cable was selected for another 2.84-mile link because of a 290-ft difference in elevations. Completion of the latter section will boost the utility's 225-kv cable system to 21¾ miles, most of which is oil-filled lead cable buried in sand-filled concrete troughs.

Additions to the French 63-kv system will be pipe-type cable for long high-capacity runs where a suitable route can be established, Tellier said. But other paper-lead types which predominate in the 1,250-mile system will be used where pipe routes are impractical or the loading will not exceed 45 Mva.

Design considerations for the 36-mile submarine-cable crossing of the St. Lawrence estuary were presented by D. M. Farnham and S. H. Cunha, Quebec Hydro, G. B. Shanklin, consultant, and H. O. Short, Canada Wire & Cable. Solution for the pressures and temperatures under 1,200-ft of water was an elliptical cable to permit the 500-psi water pressure to hold sheath and paper insulation in void-free contact.

Ontario Analyzer Data Given Station Group

Recovery voltage on a circuit never follows simple linear increase with time so that attempts to define it by a single figure convey only a fraction of the desired information. Nor can dielectric recovery in a circuit breaker be represented by a straight line. Thus concluded P. L. Dandeno and W. Watson, Ontario Hydro-Electric, and J. K. Dillard, Westinghouse, from an extensive transient analyzer study of the Ontario system after completion of 1,000 Mva on the St. Lawrence River.

Their investigation stemmed from plans to use 230-kv circuit breakers for extensive switching service at St. Lawrence Generating Station and several major switching stations. And recent adoption of air-blast breakers for 115-kv installations also required more complete knowledge of voltage recovery on the system.

Mathematical analysis showed that recovery voltage on a transmission system has a faster rise as the system expands, they said. With three generating stations expected to exceed 1,000 Mva by 1960 and several major substations to be fed by ten 230-kv circuits, faults would be severe. Their investigation revealed that ungrounded 3-phase faults impose the most severe conditions on one pole of a circuit breaker; that multiple lines substantially cut both rise and recovery voltage; and that substation loads have a somewhat similar effect.

In discussion A. J. Schultz, General Electric, indicated that the authors' rise rates were less severe than had been expected, especially for bus faults. W. F. Skeats, also GE, warned that recovery voltage would be much higher out a short distance on the lines where line characteristics exert more influence. Watson conceded that bus faults had been ruled out as impractical, but even so, the analyses had been criticized as "too severe," he said.

S. B. Griscom and D. M. Sauter of Westinghouse, and H. M. Ellis, British Columbia Engineering, showed that recovery voltage can be approximated with "reasonable' accuracy by short-cut methods requiring about 15 min per case. Key to their method is classifying system conditions into seven "cases" according to controlling features. Typical fault cases are:

1. Single and double L-C circuits.
2. Bus which feeds open-ended transmission lines.
3. Bus with shunt capacitance and transmission lines.
4. Bus at load end of transmission lines.
5. Generating station bus with transmission lines from other generating stations.
6. Circuit breaker opening a faulted line or reactor.
7. Circuit breaker fed from a power system bus opening a faulted line or reactor.

For each case the authors developed an approximation permitting simple arithmetical determination of the sinusoids which combine to trace the recovery voltage wave shapes. Results derived follow closely traces derived by tests, transient analyzers, or rigorous calculation for 40 different examples, they concluded.

Relay Men Talk on Local Backup, Microwave

Remote backup is inadequate for modern systems, said L. F. Kennedy and A. J. McConnell, General Electric Co. They suggested using a group of relays entirely separate from that for first-line protection as an adequate local backup system. Such a system, they said, would cost only about 20% more than the usual distance-carrier relaying.

General Electric authors also presented an evaluation of microwave relaying operating principles. J. Berdy, H. J. Fielder, F. C. Krings, and A. J. McConnell, gave these conclusions:

1. When there are enough available voice channels, one normally present pulse channel with orthodox blocking-type relays is an acceptable scheme. One normally present or normally absent pulse channel with permissive underreaching transferred trip is acceptable also.

2. If available channels are not sufficient for all purposes two other schemes may be considered. One is a single frequency-shift or normally present tone with orthodox blocking-type relays; the other a single frequency-shift tone with permissive underreaching transferred tripping.

Unless the industry agrees upon some minimum combinations, excessive costs and engineering manhours are inevitable, they said.

Adoption of microwave as an element of protective relaying has triggered innovations in station control circuitry at Cleveland Electric Illuminating Co, said B. F. Wirtz. Objectives were to retain the reliability and coordinated speed of microwave in applications to new and old equipment.

Types of electro-mechanical relays were retained as the fault detectors, Wirtz said, although silicon and germanium rectifiers were incorporated in their connections to make the relays suitable for local tripping and microwave transmission to remote points without adding auxiliary relays. Operation of the relay system is thus kept fast enough to take advantage of 3-cycle circuit breakers, even for a 3-terminal line where tripping follows comparison of relay indications at all terminals.

Communication needs of the electric utility industry include load and switching dispatching, load control and telemetering, supervisory control, protective relaying, and management uses.

Dispatchers should be consulted in planning the communication system, said E. S. Kocsan, Pennsylvania Electric. Their needs include flexible and reliable channels to correct system loading and voltage before sudden changes cause relay operations and system disturbances. Telemetering and dispatch computers help in

these functions. When switching becomes necessary, 2-way radio speeds it up and shortens interruptions.

Load control requires prompt transmission of pulses to correct generator outputs, said S. C. Bartlett, American G&E Service Co. These pulses originate in analyses of load information rushed to the control center. Thus telemetering is important. Adequate communication contributes to dispatch economy, cuts service interruptions, and limits system damage to a cost so low as to be completely justifiable.

Supervisory control calls for reliable 2-way channels, simple equipment, freedom from interference and legal complications, and economical installation, said C. W. Cogburn, Florida P&L. Wire circuits are preferably in lead-sheath cable but this imposes a voltage limit of 135 dc and limits the frequency range of audio tones.

Cover Lightning Protection of Aerial Cable

Protection of aerial-cable distribution against lightning was the subject of several papers. One, reporting field tests on Florida P&L Co's field-spun shielded cable by W. A. Thue of that utility, and J. M. Clayton, Westinghouse, disclosed that:

1. Cable insulation can be protected against strokes to connected open wire by arresters to 10-ohm grounds at the line-cable junction.

2. Where ground resistances are 20 ohms or more, a second set of arresters on the open wire about 500 ft from the junction helps to cut down surge energy.

3. Frequent low-resistance grounding of the messenger protects the cable against direct strokes to the messenger or shielding.

4. Wave propagation in the cable is 360 to 415 ft per microsec. Voltage at the remote end is 140% of the value entering a cable with shield grounded at both ends, 205% when grounded at only one end.

Laboratory tests by H. R. Armstrong and R. T. Curto, Detroit Edison, confirmed traveling-wave theory for aerial cable and demonstrated the need for lightning arresters at all open-wire junctions. But they found possibility of damage by pitting where a direct stroke terminates on the cable or messenger.

Further research will be required to account for the "unexplained" failures of distribution cables, both aerial and buried, connected to open-wire lines, said A. H. Shepherd and P. H. Ware of Simplex Wire & Cable. The minimum impulse strength of modern rubber insulations is more than 25% above the BIL of their voltage class, and polyethylene approaches 100%. Solid-type paper insulation has even higher impulse strength, they said. But they admitted that the dielectric strength of typical cable runs may be less than that of a test sample and that service life is the most accurate index.

Suggestions of a change in secondary metering were seen in two papers by General Electric authors. The first, by J. L. Landry and J. F. Scamman, showed that adopting separate core structures for the current and voltage coils of a single-phase meter permits an extended range to 200 amp without sacrificing light-load accuracy. The second, by D. M. Smith, applies this innovation to polyphase meters.

Urges Utility, Industrial Planners to Confer

Experience of Louisiana Power & Light Co indicates that a utility company can supply the class of service required by the modern industrial plant utilizing highly automated and critical processes, according to H. L. Deloney and J. Davey. But to do this the utility and industrial planning engineers must recognize each other's problems early in the design stage of new construction so that equipment can be selected, applied, and designed to give optimum performance.

Separate source not paralleled, loop circuit transmission, and three or more supply circuits supplying a common bus are some supply facilities Louisiana Power & Light Co has used to feed these critical loads. Choice of arrangement depends upon location of the load with respect to the utility system and upon the load size.

A combination of under-voltage and under-frequency relays has given satisfactory results in providing high-speed automatic transfer of loads. The under-voltage relay provides the initiating impulse for line-to-line and 3-phase faults. For single-line-to-ground faults the under-frequency relay takes over.

The authors presented details on the effect of capacitors on regenerative voltages. They indicated that the maximum regenerative voltage to be expected on motor circuits where excessive capacitors or line charging is present during switching is in the order of 165 to 170% of rating, limited by motor and transformer characteristics. Power factor correction capacitors should be eliminated or switched automatically to minimize the effect of this regenerative voltage. Otherwise this regenerative voltage materially affects the asymetrical inrush current when the motors are re-energized.

V. C. Geckler, General Motors, predicted an expanded use of high frequency power inside the future industrial plant. But, with the exception of special applications where there is a large fixed high-frequency requirement, automation and integrated line will dictate the use of small-size generating units. Geckler said these units will be located and sized for particular production lines. Generating units used for these integrated lines will not be direct connected but V-belt driven units on which the belts may be changed to vary the generator speed to gain a different frequency.

New Sampling Technique Cuts Meter

Vepco, with okays from three state commissions, replaces outmoded periodic tests with new selective testing program

W. C. HARRISON, System Meter Supervisor, Virginia Electric & Power Co, Richmond, Va.

Modern meters can be left in service for many years without attention, whereas older meters may require more frequent inspection. Despite this, regulatory commissions have sanctioned few changes over many years in the practice of testing meters on a flat periodic cycle, except to increase the length of time between tests.

A progressive step was made recently, however, when three state regulatory commissions permitted Virginia Electric & Power Co to replace this outmoded practice with a new plan for selective testing of all single-phase watthour meters in service. The company has had the plan approved by Virginia State Corporation Commission, Public Service Commission of West Virginia, and North Carolina Utilities Commission.

Under the new plan a scientific sample is to be drawn each year from the total number of single-phase watthour meters in service, and the sample brought into the shop for testing. A detailed analysis of the accuracy of such meters by types and geographic locations will be studied; from the results additional meters may be pulled for test, as the sample indicates.

Selective testing has these advantages over periodic testing:

- Time spent on meter testing may be utilized more efficiently. A modern sampling procedure points out the types of meters that may be in need of recalibration. Therefore, time is not wasted in testing meter groups where need for recalibration is not indicated.
- Data of measured reliability may be obtained with respect to the performance of various meter types and service under different conditions. This was not possible under the old periodic testing.
- The sampling procedure discloses meter types which may not retain accuracy for extended periods. They will be tested more frequently than every eighth year and will be subject to earlier retirement.
- Selective testing is compatible with what is believed to be the ultimate solution to the meter accuracy problem—development of a low-cost, single-phase watthour meter which will maintain desired accuracy for its life of 20 to 30 years and be replaced by a new one.

The art of scientific sampling has been well developed in many branches of industry and has proved a most dependable mathematical method of securing reliable data with a minimum of actual work. Careful study proved that such sampling, combined with a selective system of testing meters, (1) would prove superior to the flat periodic cycle method in general use, and (2) would, in effect, give the advantage of a longer test period without jeopardizing overall accuracy of the meters.

Vepco, like other utilities, has had a phenomenal growth during the past 15 years. As a result, more than 90% of Vepco's meters are now of modern types, largely mounted outdoors in approved modern meter mounting devices. An

CO. NUMBER | MFGR'S NUMBER | MAKE | TYPE | WIRES | DELTA | WYE | VOLTS | AMPS | TYPE DEM

W. H. CONST. | REG. CONST. | REG. RATIO | GEAR RATIO | 1ST REDUCTION | DATE OF TEST | TESTED BY | FIELD PER | SHOP PER

FOUND READING | LEFT READING | DEMAND READING | SEALED | TO SHOP YES NO | TIME ARRIVED | TIME LEFT

LOAD	AS FOUND METER REVOL	AS FOUND RECORDED STD REV	AS FOUND STD REV	AS FOUND % REGIST	AS LEFT METER REVOL	AS LEFT RECORDED STD REV	AS LEFT STD REV	AS LEFT % REGIST

CREEP | SVC VOLTS | SVC GROUND

REPAIRS | DF | S | P | J | G

TEST STD NO

TEST STD CONST

METER CHANGE

	METER NO	AMPS	CONST	READINGS	DEM
ON					
OFF					

DATE WORKED | WORKED BY

REASON FOR CHANGE

REMARKS

SIMPLIFIED RECORDS can relieve overburdened meter departments. On this form Vepco has abandoned practice of assigning a company number to meters (upper left) and is using the manufacturer's own serial number instead.

Testing Cost

1% SAMPLE of meters is taken by drawing each 100th billing stencil from files. Clerk uses simple flat brass gauge to measure 100 stencils accurately

analysis of Vepco's test results indicated that more than 98% of all watthour meters in service are recording within acceptable accuracy limits.

The commissions of Virginia, West Virginia, and North Carolina have established ±2% as the limits of acceptable accuracy. In determining which meters might be expected to fall outside the accuracy limits between normal test periods, a number of samples were drawn from tests performed in previous years. These results, being segregated by makes and types, indicated in every case, as would be normally expected, that meters in older age groups were most often found beyond acceptable accuracy limits.

This indicates that it would not be desirable to extend a periodic cycle much beyond the present eight years, without taking into account older meters not containing inherent design characteristics that would insure sustained accuracies. From this study it was decided that a selective plan could be adopted to cover such conditions.

For the Vepco system it was computed that a 1% sample, representing 8,000 meters, would provide a sufficient number of single-phase watthour meters of every type in service to present a true picture of the general condition of all such meters. This sample was drawn by selecting each 100th billing stencil from the 800,000 stencils kept at a central location.

A simple flat brass gauge was designed to measure 100 stencils accurately. As each drawer in the file cabinets contains about 350 stencils, a slide was devised to measure the odd quantities at the end of the drawer. This slide fits over the brass gauge and is spaced at the end of each drawer to cover that portion less than 100 stencils. It can be positioned at once in the next drawer to select the remainder.

Drawing of the sample was completed by regular billing clerks. It required 43 man-hr to draw the sample and 20 man-hr to refile the stencils. Only 12½ machine-hr were required to run the stencils through the billing machines for printing the meter change orders.

To assure the accuracy of the sample, a member of the auditing and procedures department stood by for general supervision and to be sure that no sections of the files were skipped. In future years this may not be necessary.

After the change orders were printed in the billing department, they were forwarded to the various districts for further processing and execution in the field. Results of these tests are being posted carefully by make and type and listed to 0.1%.

A summary of these test results for the entire 8,000 watthour meters will be analyzed. From these results an additional group of meters will be selected and brought into the labs for testing.

Test Meters in Problem Areas

Previous studies indicate that for the first few years a large number of meters will be selected from the oldest age group so that these meters might be retired. A quantity will also be selected for test from areas that are exposed to unusual lightning hazards, salt spray, or similar conditions. It is also planned to pull meters for test in some quantity from the older areas of the system where wiring may not be up to present standards and where irregular wiring practices might be discovered.

It can be seen that under such a plan the system may soon be cleared of undesirable types of meters. Also, all selective tests, by being directed into areas of greatest need, would produce with minimum effort the greatest benefit to the company and its customers.

Drawing of a new sample each year will result in an annual appraisal of the performance of meters by types in service and of changes in overall accuracies. Within a few years, with undesirable meters removed and retired, it will be possible that the percentage within the sample will be reduced. All testing activity could then be concentrated on types of watthour meters or on those meters in geographical locations where the need for close surveillance is indicated.

Types of meters and adverse locations now affecting meters may not be important in the future, yet new problems may develop. Such changes will be revealed as they occur by analysis of the annual sample, thus directing concentrated test activity to those areas.

Adoption of such a test program will have as an immediate effect a large reduction in the number of meters that must be tested each year, along with the resulting economies. Additional savings may be realized if a study is made of other related operations within the meter department.

Most meter departments have been overburdened in the past with records. Many of these records can be consolidated or eliminated with-

out jeopardizing the proper operations of the company.

Several changes have been in effect in Vepco for some time, and no trouble has been experienced. These changes include abandoning use of the so-called history card; using the manufacturer's serial number instead of assigning company numbers to meters; and giving a time run test only to new single-phase meters.

With this new test plan Vepco believes it can consolidate its eight district meter departments into three division departments and ultimately into a single system department. These eight district departments serve a territory of about 34,000 sq miles.

With fewer meters to handle in the shop, it is felt that this consolidation of operations is practical. Such a plan will enable Vepco to streamline shop production, with a further reduction in operating expenses. It will also permit training a small corps of skilled metermen within a few major departments or a system department; it will eliminate the need for training many field testers, who have been difficult to obtain in the present labor market.

Vepco has removed all meters for test for the last nine years in all rural areas. This work has been performed by regularly assigned area servicemen who act as district representatives in small towns and communities. This plan will be continued under the new test procedure.

A Big Step Can Be Taken

Meter departments in cooperation with manufacturers can take a big step to realize more savings within our industry—that is, the development of a low-cost, single-phase watthour meter that could be put in service for its life of 20 to 30 years and then be retired and replaced with a new meter.

Such a device, not beyond the realm of possibility today, will require a change in thinking of many of our meter engineers. In the past most metermen have been inclined to think in terms of laboratory accuracies rather than in the more realistic commercial accuracies that could be established when weighed in the economic balance.

Accounting departments have already taken the lead in this respect. They have dropped pennies in their tabulations of various reports; they have used meter readings in even digits and are now reading only in units of ten. Bi-monthly billing has been accepted as common practice, final bills are being estimated, and various sampling means are being used in auditing and verifying accounts. They will readily welcome, in most instances, the help of their meter departments in reducing expenses of overall operation.

This selective testing procedure is intended to apply only to single-phase watthour meters used without auxiliary equipment. All polyphase meters and single-phase meters with instrument transformers will be tested at regular periodic intervals—up to 100 kva, once in 3 years; over 100 kva, once in 1½ years.

METER ACCURACY SUMMARY SHEET

DISTRICT Blue Ridge

TYPES											TYPES									
% REG.	H	%	I-14	%	OA	%	M	%		%	% REG.	H	%	I 14	%	OA	%	M	%		%	
											100.0	16		7		4						
99.9	12				1						100.1	3				1						
99.8			7		3						100.2			1								
99.7	8		5								100.3	2		3		2						
99.6	6				7						100.4											
99.5											100.5			1								
99.4											100.6	1				1						
99.3	3				2						100.7											
99.2			2								100.8											
99.1			3								100.9											
99.0	1				1						101.0											
98.9	3		5								101.1	3				3						
98.8					6						101.2	4										
98.7	1										101.3											
98.6			3								101.4			2								
98.5					3						101.5											
98.4	2		1								101.6	1										
98.3					2						101.7			1								
98.2	4										101.8											
98.1											101.9					2						
98.0	2										102.0											

TEST RESULTS are posted by make and type on summary sheet by individual districts. Then a summary of these results for the entire 8,000 meter sample will be analyzed and an additional meter group will be selected for testing

Report by EEI Committee . . .

Views Systems Planning Trends

System planning is the foundation upon which utility engineers build to their objective of a high quality of service at the most economical cost. As a philosophy of system planning generally evolves through experience and exercise of judgment, it is most important that system planners be informed of industry practices and experience.

Recognizing this need for information, the working Group on Planning Practices of the System Planning Subcommittee of the Electrical System and Equipment Committee, Edison Electric Institute, presented a report (No. 57-4) which summarizes the system planning practices of 46 companies in 1955. These companies represent over 50% of invester-owned generation in the country. Their total 1954 non-coincident peak load was 46,969 Mw. In the same year, 96% had peak loads of 200 Mw or more, and 85% a system load density of 1,000 kva/sq miles or less. A winter peak is normal for 75%. The median service area is 3,865 sq miles, the average, 11,500 sq miles.

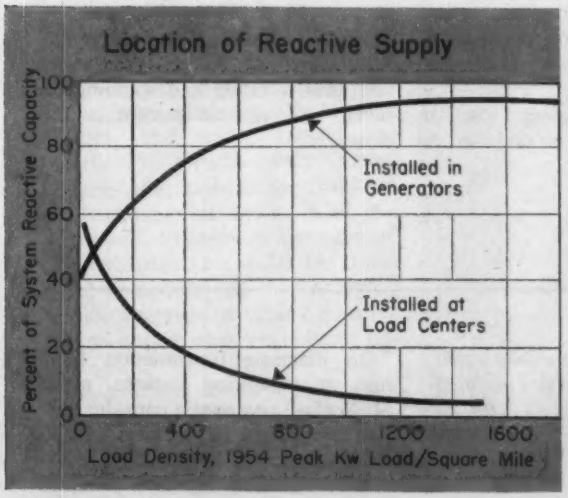
The report does not reduce to "preferred standards" of system planning. Nor did the subcommittee expect at the outset to find such standards. Rather, the practices may be taken as guides by system planners in evaluating their philosophies against the experience and rules of others. With this objective in mind, Electrical World presents the most important trends and practices in today's system planning.

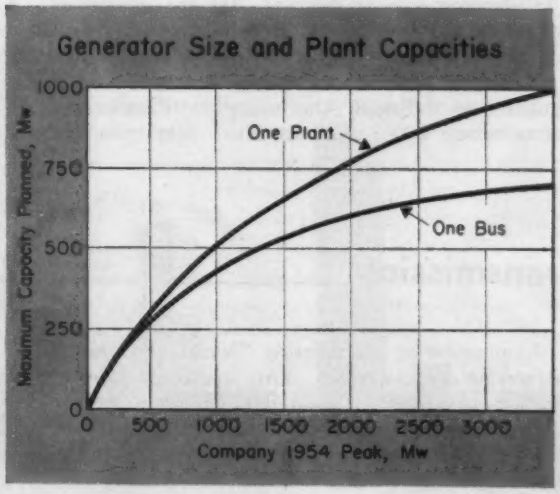
Generation

Emerging as a trend is the relation between company size and the criteria used in planning installed reserve. The larger the company the greater is the acceptance of percent margin above peak and less the preference for backup of the largest unit. As average load density increases, the trend is to supply more reactive from central stations and less at load centers. In planning reactive reserves, most companies use loss of largest unit as a criterion or consider as sufficient the reactive installed for voltage regulation. Within the next five years, maximum single plant size will be 1,350 *Mw, with* 1,000 *Mw planned for one bus.*

Current practice finds 22 companies planning installed reserve on the basis of loss of largest unit, 18 companies using percent margin above peak. Probability-of-outages theory is used by eight companies, five of which are 2,000 Mw or over. Among these eight, five use probability to calculate percent margin, two to evaluate loss of largest unit and percent margin, and one to plan for once-in-five-years contingencies. Four companies consider an outage of a second machine during shutdown of another in planning installed reserve. Most companies, regardless of size, schedule spinning reserve on the basis of loss of the largest unit.

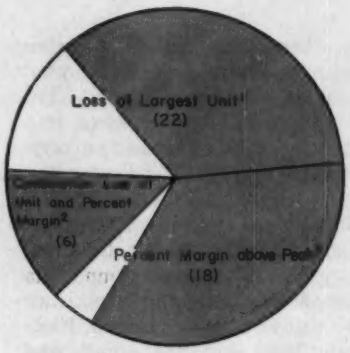
Among 13 companies serving interruptible loads, eight do not consider these loads as either installed or spinning reserve. Almost all companies rely upon central stations for 30 to 95% of reactive requirements. Reactive at





Criteria Used in Planning

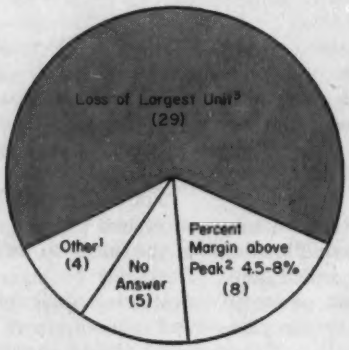
( ) Number of companies so reporting



Installed Reserve

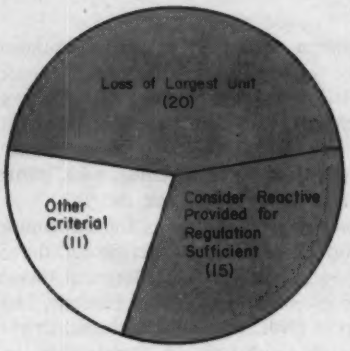
Shaded area indicates proportion of companies reporting inter-connections influencing capacity reserve.

1. Three companies plan reserve equal to largest unit plus an amount from 23 to 50 Mw.
2. Generally whichever is greater.
3. Of companies maintaining margin, almost all use 10-15%.



Spinning Reserve

1. These companies, although not within power pools, depend on interties for part of their reserve.
2. Three companies are members of pools which maintain a percent margin for the pool.
3. Four companies are pool members and plan for an outage of the largest unit in their pools.



Reactive Reserve

1. Other criteria include two companies each reporting:
   - No definite policy on reactive reserve
   - Using margin above reactive load
   - A combination of loss of unit and ability to regulate

Three companies reported planning based on loss of two largest units. Two did not answer.

load centers supplies 5 to 100% of total requirements for 40 companies; interconnections to 28% for eight.

Except for reactive at central stations, more companies have more reactive on distribution feeders than at either bulk supply or distribution substations. Capacitors on feeders generally are unswitched, switched units being mainly at substations.

In planning reactive reserves, 20 companies use loss of the largest unit as the criterion and 15 consider reactive provided for voltage regulation as sufficient. One utility maintains near 100% pf on distribution substations and 95% pf on transmission substations; another maintains all load areas self-sufficient in reactive, and one adds 1 kvar reactive per kw of new load.

Reactive reserve is modified by policy on lowered voltage during emergencies. Up to 5% reduction is permitted by 18 companies, 6 to 9% by six, 10% by two. Lowered voltage for the duration of the emergency is accepted by 54% of the companies. A majority takes reactive over interconnections as it is available but without prearrangement.

Restrictions on plant size or maximum generation on one bus are expected by 20 companies, or 43% of the total. No answers were submitted by other companies. Restrictions on plant size include water and site limitations and short-circuit duties. Maximum generation on one bus will be restricted because of short-circuit duties and to limit an outage to one unit.

Generator size is restricted by six companies to 10 to 25% of system capacity, and plant size by four to 17 to 50% of system capacity. Interconnection or pooling arrangements modify generator size, and installed and spinning reserve, although no pattern is evident.

Transmission

Elimination of transmission "bottlenecks" becomes more important as service area increases. This is evident from the tendency to plan for no curtailment of economic generation at all load levels with all lines in service. Five companies reporting single-phase transformers for transmission substations indicate future trends in planning, although 3-phase units predominate in present planning.

In planning transmission facilities at generating stations, about 50% of all companies consider generator capacity curtailment acceptable following loss of two overhead circuits on one tower line, provided

there is no loss of load. Contingencies considered by a number of companies are given in the bar chart. Other contingencies considered by individual companies are: Loss of one bus section, or a single bus in a two-bus section, or loss of all lines on a single right-of-way, or overlapping outage of any facility (more than three weeks to repair or for maintenance) with another single bulk supply.

Where load is supplied directly at generator voltage from plants connected to the transmission system, 12 companies consider outage of the largest transformer in planning transmission capacity. Outage of the largest generator is considered by 11 companies; outage of the largest generator and the largest incoming line by eight, and outage of the two largest units by seven.

In planning supply to a large bulk substation, almost all companies in all size catagories consider an outage of the largest overhead line or cable. An outage of two circuits on one tower line is considered by 13 companies. There is no apparent relation between isokeraunic level and transmission reserve.

Today's practice favors 3-phase transformers in transmission substations, but three companies prefer single-phase units and two use both types. Of the last two, one uses 3-phase units only in double-bank substations or where subtransmission provides backup. In the early development of substations, a majority finds single-bank installations acceptable. Maximum sizes range from 5 to 120 Mva, 21 to 100 Mva predominating.

To carry the load in a transformer failure, 28 companies pick it up on the subtransmission network, 24 transfer manually to other sources, and seven transfer automatically. While 14 companies replace the transformer with a single-phase unit available at the substation, 13 move in a stock unit. Mobile spares are used by three. Most companies do not accept a service interruption of any duration due to outage of a single-bank station.

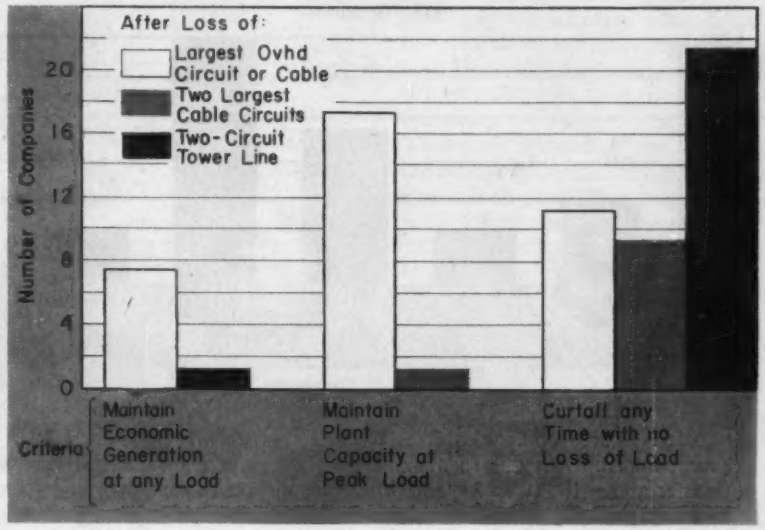
In planning multi-bank substations, 38 of 44 companies provide sufficient reserve to carry all load, should one bank fail; no company provides reserve capacity for a two-bank failure. In many cases reserve capacity is provided through the subtransmission network. Reserve capacity also is obtained through supplemental cooling and/or overload and calculated loss of life. Only six companies accept load curtailment following a transformer failure on peak load.

Spare transformers are provided by 31 companies, 19 holding spare 3-phase units at the substation and four at a central location. For single-phase units, 15 companies keep spares at central locations; 13 at substations.

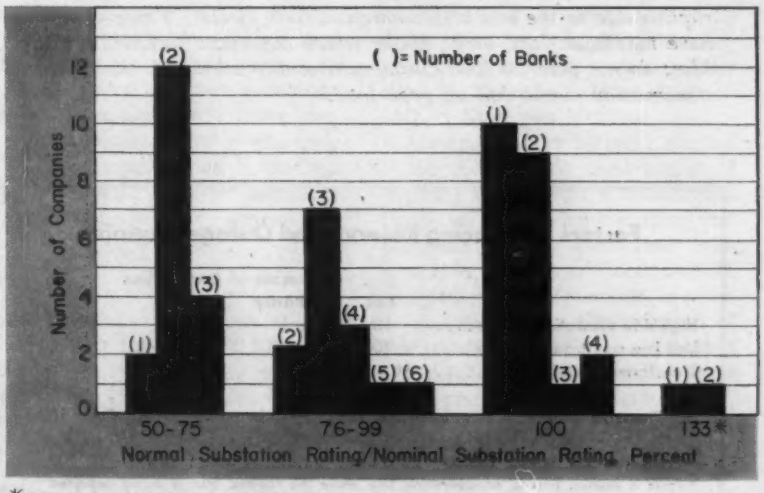
Half the companies do not contemplate momentary load interruptions due to any faults and/or transmission or transformer faults when planning multi-bank substations. Interruptions during automatic transfers are accepted by 11 companies, and during manual transfers at attended substations by seven.

Of nine companies listing maximum loads beyond which interruptions due to transfers are unacceptable, three have a limit of 10 Mva, five a limit of 10 to 25 Mva, and one of 50 Mva during automatic

Planning Transmission at Generating Plants



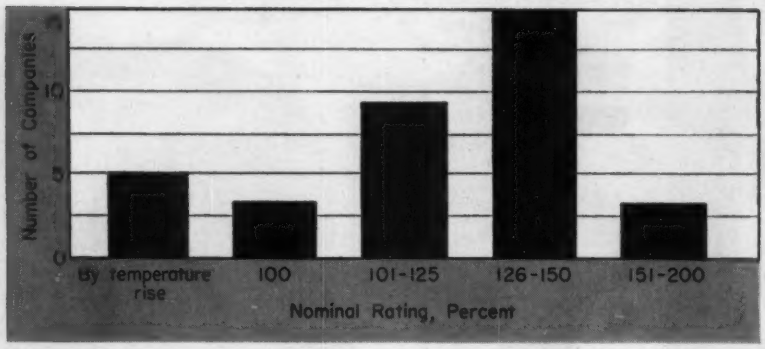
Normal Transmission Substation Ratings



* Effect of ambient temperature, daily load cycle, etc

Maximum Emergency Transformer Loadings

(37 Companies)



transfer. Three companies do not accept interruptions due to manual transfer above 10, 10 to 25, and 50 Mva, respectively. One company has no limit to the amount of load it will interrupt during transfer.

Ratings of transformer banks in transmission substations range from 5 to 125 Mva, the most prevalent sizes in the 26 to 50-Mva range. Only eight companies plan to use single-phase units, two companies reporting bank ratings in the 101 to 125-Mva range.

Currently planned are substations with total ratings of 5 to 480 Mva. Most of the 38 companies reporting have nominal sizes in single and multi-bank stations from 26 to 200 Mva. Ten companies report multi-bank ratings in the 201 to 300-Mva range; three will install 301 to 500 Mva in two, three and five-bank stations, respectively.

Emergency ratings of transformers based on calculated loss of life are used by 17 companies, with one daily load cycle or the duration of the emergency the criterion. Several use both criteria. For emergency loading during one daily load cycle, six companies use 0.1-0.5% loss of life, four use 0.6-1.0%, and two use 1.1-2.5%. For the duration of the emergency, seven companies use 1.1-2.5% loss of life, three 2.6-5%, two 6-10%, and one 11-15%.

To carry the load of a transmission substation should a bus fail, 24 companies always provide for transfer, and 17 companies sometimes do. For load transfer following a bus-tie breaker failure, 19 companies always make provisions and 20 sometimes do.

Location modifies acceptance of double-circuit steel tower line as firm supply to bulk substations

Location	Considered as Firm Supply Companies reporting, percent			
	Yes	No	Conditional	Replies
Isolated r/w	62	33	5	42
Adjacent to railroad	55	42	3	38
On public highway	31	64	5	36

Subtransmission

Most companies restore service either manually or automatically by line sectionalizing, or transfer to another line following an interruption due to the loss of a subtransmission circuit. Three companies have maximum load limits above which automatic facilities are used. Most do not plan for load curtailment at any substation should a subtransmission circuit fail on peak load.

Factors Influencing Reserve and Outage Planning

	Number of Companies			
	Yes	Partly	No	
High-side substation buses	13	11	11	
Unit line and transf. supply	10	9	16	
Transformer switching*	Manual	Auto	None	
	19	14	17	
Hot line maintenance	Below 5 kv	7–15 kv	28–69 kv	Over 100 kv
	10	5	12	4

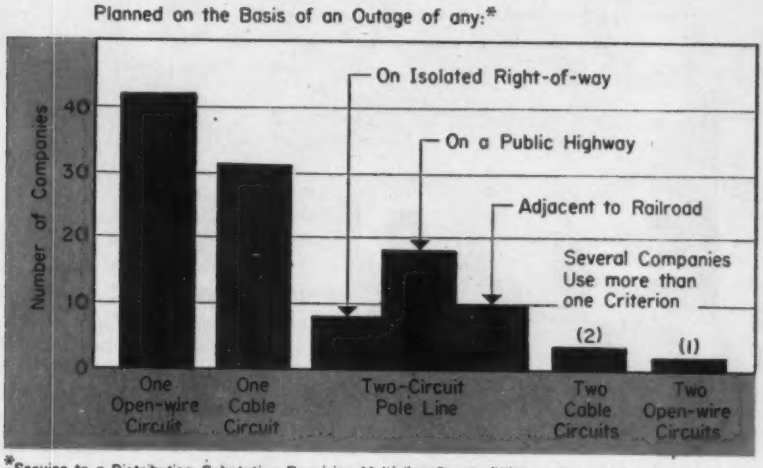
* From a faulted line to an operating line while the faulted line is being repaired

Subtransmission practices disclosed in the report are based on "intermediate-voltage lines generally supplying distribution substations and some industrial customers." This "intermediate" range may cover lines from 12 to 115 kv and beyond.

Current practice is to plan service to a multi-source distribution substation, without planned load curtailment, on the basis of one open-wire circuit out. Other important criteria are given in the bar chart. Among 17 of 36 companies, it is considered that reserve for a two-circuit subtransmission pole line can be furnished by the other circuit on the same line.

Should loss of a subtransmission circuit cause a load interruption, 34 companies restore service by line

Planning Subtransmission at Distribution Substations



*Service to a Distribution Substation Requiring Multi-line Supply (Without Planned Load Curtailment)

sectionalizing or transfer of load to another line. Among several companies, use of manual or automatic restoration is dictated by the specific situation. Three others have maximum load limits—3 to 5 Mva—above which automatic equipment is used.

Among 13 companies, no reserve subtransmission-line capacity normally is provided for industrial customers supplied directly from subtransmission lines, except at the customer's expense. Reserve for critical loads only is provided by 16 companies. All industrial loads above a given size, 1 to 10 Mva, have reserve provided by four utilities. Two companies plan reserve for customers supplied from underground cable systems. These minimum sizes of customer substations are served from subtransmission lines: Up to 500 kva, 18 companies; 500 to 1,000 kva, five; over 1,000 kva, six.

Load curtailment at any substation in a subtransmission line failure at peak load generally is not planned by 32 companies, but is planned by five and sometimes planned by one. Among the 32 companies, load is curtailed by eight only for substations with peak loads below 1.5 to 6 Mva, with 3 Mva the median. Subtransmission supply to a primary network to cover the outage of one line is planned by 17 companies. Some of these, along with others from a total of 20 replies, provide for the loss of all subtransmission lines on the same pole line or from a common bus section.

Joint-pole use practice includes: 20 companies plan transmission and subtransmission on the same pole line; 45 place subtransmission and distribution on the same pole line, and 45 operate distribution circuits joint with communication circuits; 34 companies plan subtransmission circuits joint with communication lines.

Distribution

Economic considerations continue to limit the sizes of distribution substations, company policies playing a secondary but significant role. Three-phase transformers for distribution substations predominate in present planning. Spare transformers, both single and 3-phase, for multibank substations generally are kept at central locations.

Only seven utilities plan to adopt a future standard primary voltage different from their present standard. One company listed 22 kv as a new future standard. Higher average and maximum feeder ratings in the 4 to 5-kv and 13.8-kv classes are contemplated as future standards.

Spot networks to supply large loads with other than existing network voltages are planned by 57% of the utilities. Preference among 12 companies is 2:1 for 4 kv over 11 to 13.8 kv as the future standard feeder voltage for primary networks. Only about 28% of the companies plan to install substantial numbers of banked-secondary distribution transformers.

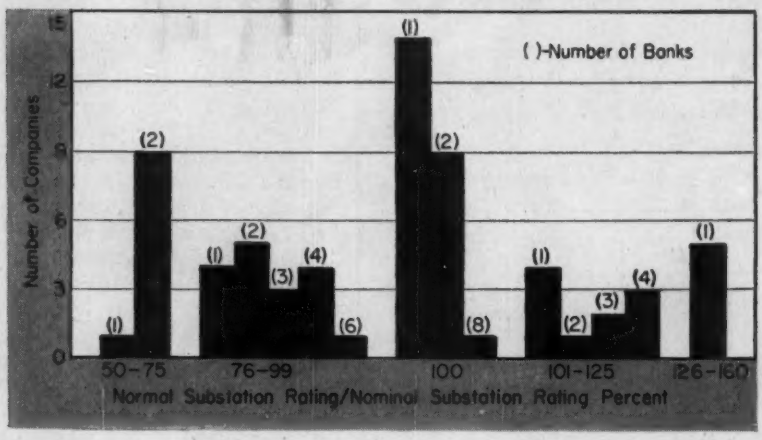
In establishing limits on sizes of distribution substations, 28 companies say economic factors are paramount; nine list economics and policy; and five cite policy alone. Three-phase transformers are used by 41 companies. Ten utilities listed both 3-phase and single-phase units as standard. Maximum 3-phase ratings vary from 3 to 50 Mva, with 6-9.9 Mva the prevailing range and used by 19 companies. Several companies have more than one standard size.

Present practice in single-bank, 4-kv substations finds 29 utilities using a maximum transformer size up to 10 Mva, with about 5 Mva the average. One company has a 12.5 Mva maximum. Among 19 utilities, maximum sizes of 11 to 14 kv single-bank substations range up to 15 Mva, about 7.5 Mva the average. Two companies have maximum sizes of 20 and 25 Mva; three 30 and 35 Mva; one 50 Mva.

Manual transfer to other sources is the most widely used means of carrying the load in a transformer failure at a single-bank station. Replacement of the transformer with a mobile spare is a practice of 31 companies. Other methods, in order of preference, are: Replacement of the transformer with a stock unit; Open-delta operation until a spare single-phase unit is installed; and, use of a primary network of distribution feeders.

Automatic or manual throwover is used by 39 companies to con-

Normal Distribution Substation Ratings



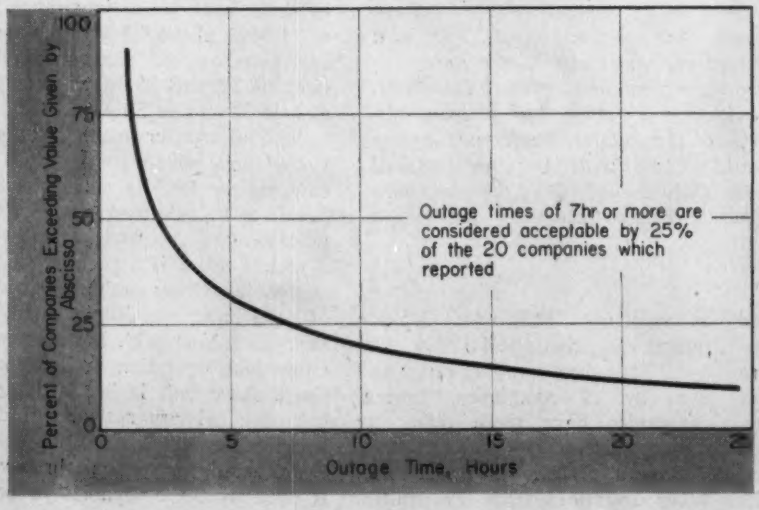
nect single-bank distribution substations to an alternate source, 19 companies using both. Selection of automatic or manual facilities is based on the amount of load to be transferred, although no general agreement on load limits is apparent. Manual transfer only is used by 15 companies; five use automatic transfer only.

Of 41 companies responding, 37 plan reserve capacity to carry all loads in event of a single-bank failure in multi-bank substations. No company provides reserve for a two-bank failure. Load curtailment is accepted by four companies following failure of a transformer at peak load. A majority of companies keeps 3 and single-phase spare transformers at central locations.

Of the reporting companies, 27 or 68% accept momentary load interruptions at multi-bank distribution substations during automatic transfers due to any type of fault and/or transformer or line faults. Interruptions during manual transfer at attended substations are acceptable to 12 compaines for any fault. Momentary interruptions are not contemplated by five companies for any type of fault, by six for transformer faults, and by four for line faults.

Of the 27 compaines which accept momentary interruptions during automatic transfer, six have a 1 to 5-Mva limit, ten a 6 to 12 Mva limit, and two 13 to 20 Mva.

Maximum Acceptable Outage Time for Single-bank Substation Failure



Nine will interrupt total load. During manual transfers, nine companies will interrupt total load, and seven find interruption of total acceptable for any type of fault. One company will interrupt 13 to 20 Mva, four 6 to 12 Mva, and four 1 to 5 Mva, depending upon the type of fault.

For 4-kv multi-bank substations currently planned, 25 or about 76% of reporting companies list maximum sizes from 6 to 35 Mva, with 17 Mva the average. Four companies plan maximum sizes in the 36 to 55-Mva range. For 11 to 14 kva substations, a maximum of 16 to 55 Mva is planned by 13 companies, with 35 Mva the average. Four utilities plan maximum sizes of 100 to 200 Mva; six a maximum of 6 to 15 Mva; and two up to 5 Mva.

Although most companies rate their distribution substations equal to or less than the nominal rating (maximum forced-air value, if fans are used), the normal rating extends from 50 to 160% of nominal. Of 39 companies reporting, 15 each plan for maximum emergency loadings per transformer bank of 100 to 125% or 126 to 150% of nominal rating, eight allowing 151 to 200% of nominal. One follows ASA guide C57.32.

Most companies usually provide for carrying the load of a distribution substation in a bus or bus-tie breaker failure. Nineteen transfer the load to other sources; seven use portable substations; and four provide a transfer bus. Four companies make no povisions covering bus failures, and 12 make none covering bus-tie breaker failures.

A new future standard primary feeder voltage of 22 kv was listed by one of seven companies which plan future standards different from their present ones. Two companies reported 11 to 13 kv as their future standard. Leading all other voltage classifications as the present standard is 4 to 5 kv, with voltages of 8 to 15 kv a close second. Two voltages are listed as standard by 32 companies while eight list 4 to 5 kv and four companies 8 to 15 kv as their standard.

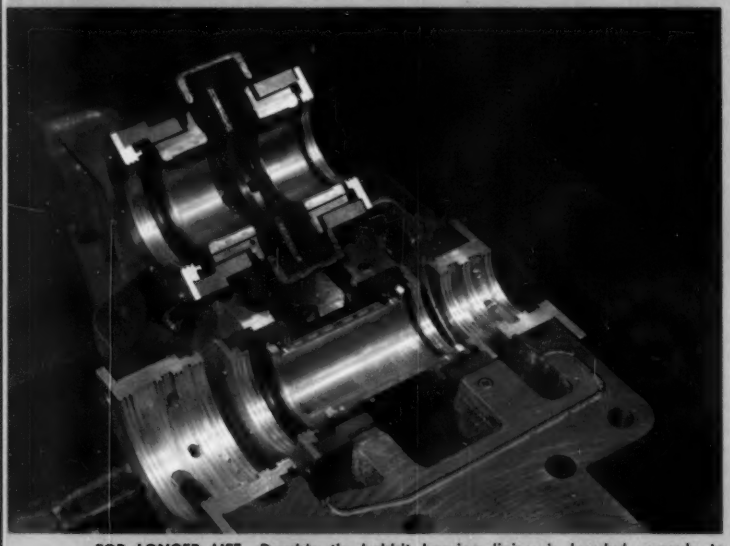
The report disclosed a trend toward higher average and maximum feeder ratings for both 4 to 5-kv and 11 to 13.8-kv systems.

(*Continued on page* 148)

At Kansas Gas and Electric...
General Electric Boiler Feed Pump Motors Help Meet 41.8% Peak Load Increase
New, quiet-operating General Electric boiler feed pump motors are vital components of the G-E equipped No. 3 generating unit at K. G. & E.'s Murray Gill Station. The new unit adds over 100,000 kilowatts of production capacity to this station . . . a capacity that exceeds the total of all Kansas Gas and Electric Company plants at the end of World War II. In the past two years peak load demands on this utility have increased 41.8%.
New General Electric boiler feed pump motors help K. G. & E. meet this demand because they are designed and built to provide the higher horsepower, and the more efficient and reliable performance needed in modern power station auxiliaries. For example, new Polyex® insulation system extends motor life up to 100%. Split end shields and air deflectors facilitate bearing, coil and air-gap inspection . . . and permit the rotor to be pulled without removing the motor half-coupling. Years-ahead design features, such as the unique General Electric air pressure seal, further cut maintenance requirements... lengthen motor life.
Where electricity is generated, electric drives give top performance
...here's why
ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY
Progress Is Our Most Important Product
GENERAL ELECTRIC

ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY

Pressure-sealed bearing system extends life of New G-E Boiler Feed Pump Motors



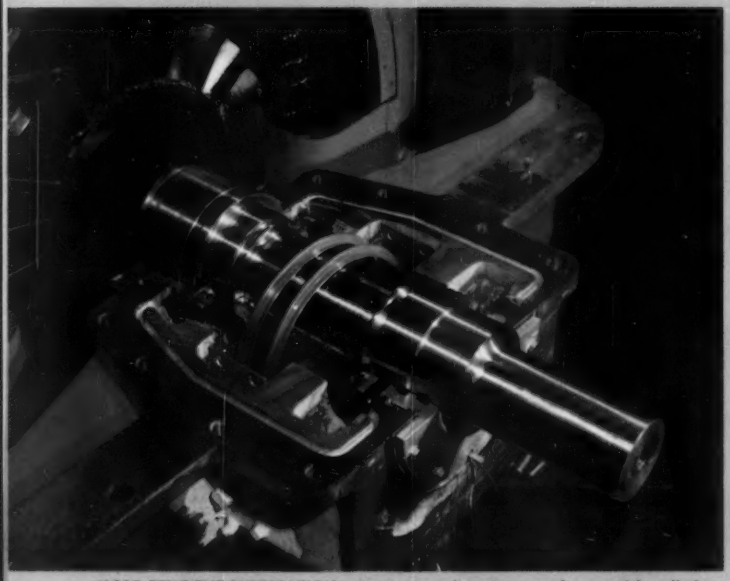
FOR LONGER LIFE—Durable tin babbit bearing lining is bonded securely to bearing shell by large, dovetail anchor grooves. Bearing shells are supported on a bearing housing integrally cast in the split end shields. Bearing length is about 1.5 times journal diameter for best distribution of pressure over entire length.

General Electric engineers have designed new G-E boiler feed pump motors to operate with maximum reliability and minimum maintenance. For example, the advanced bearing system has these outstanding features:

- A *triple* set of seals keeps oil in the bearing housing and better protects against entrance of dust and dirt.
- A primary oil pressure feed *and* a secondary oil ring system provide more dependable, efficient bearing lubrication.
- An oil reservoir cast in the lower half end shield utilizes a dam or weir to maintain proper oil level at oil rings.
- Rugged bearings are Kolene processed and dovetail grooved to give long-lasting bonding to bearing shell.

The carefully designed, precision-built bearing system requires much less attention than ordinary systems and adds to the service life of the new motors.

A pressure-sealed bearing system is just one of many reasons why G-E motors operate more reliably, more efficiently and economically. For complete information on General Electric's new boiler feed pump motor, contact your nearest G-E Apparatus Sales Office or write section 882-4, Medium A-C Motor and Generator Department, General Electric Company, Schenectady 5, New York.



MORE EFFICIENT LUBRICATION—A pressure oil system supplemented by oil rings provides positive low-maintenance bearing lubrication. The pressure system feeds oil directly into the bearing to lubricate and cool the surface. The oil rings, which ride directly on the shaft, draw oil from reservoir in bearing housing.

MORE EFFECTIVE BEARING SEALS—Static air pressure applied through cored passage is exerted on each side of bearing housing to provide a constant air pressure seal. This seal supplements slingers and close-running labyrinth seals.

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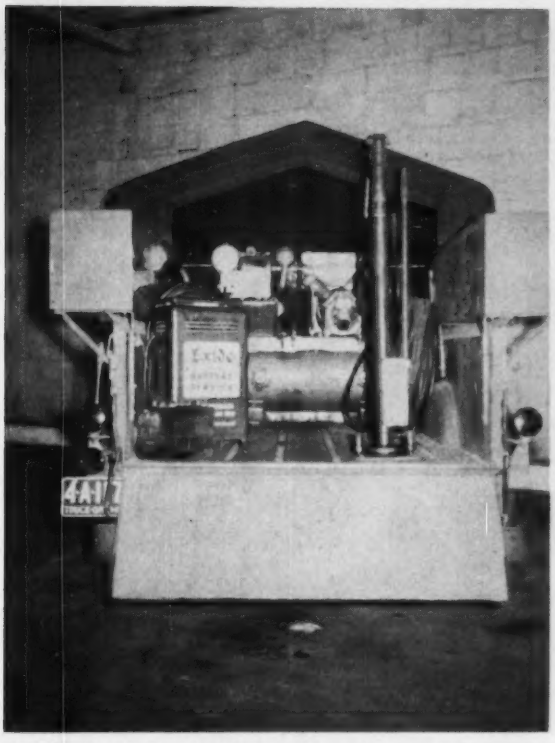


SPECIALLY EQUIPPED TRUCK visits outlying sub-headquarters to do minor repairs and servicing company's vehicles

150-LB HOIST is only one of the special pieces of equipment on the service truck for making repairs in the field

DISTRIBUTION—Maintenance

Special Truck Cuts Auto Service Costs

J. L. PECK, Superintendent, Transportation Department, Toledo Edison Co, Toledo, Ohio

Maintenance of automotive equipment at Toledo Edison Co's outlying sub-headquarters is facilitated by a specially equipped service truck. The company operates three line department sub-headquarters, one system operations headquarters and several other outlying parking areas where company vehicles are stored each evening. These sub-headquarters and parking areas are 2½ to 10 miles from the central garage.

The service truck is a ¾-ton unit which is equipped with side boxes containing fast-moving parts such as spark plugs, head lamps, fuses, points, battery cables, and batteries. In the truck there is a 150-lb air compressor for inflating tires, a heavy duty, fast battery charger, distilled water container, and a 1,000-lb hoist for lifting heavy truck tires into the truck for return to headquarters for repairs.

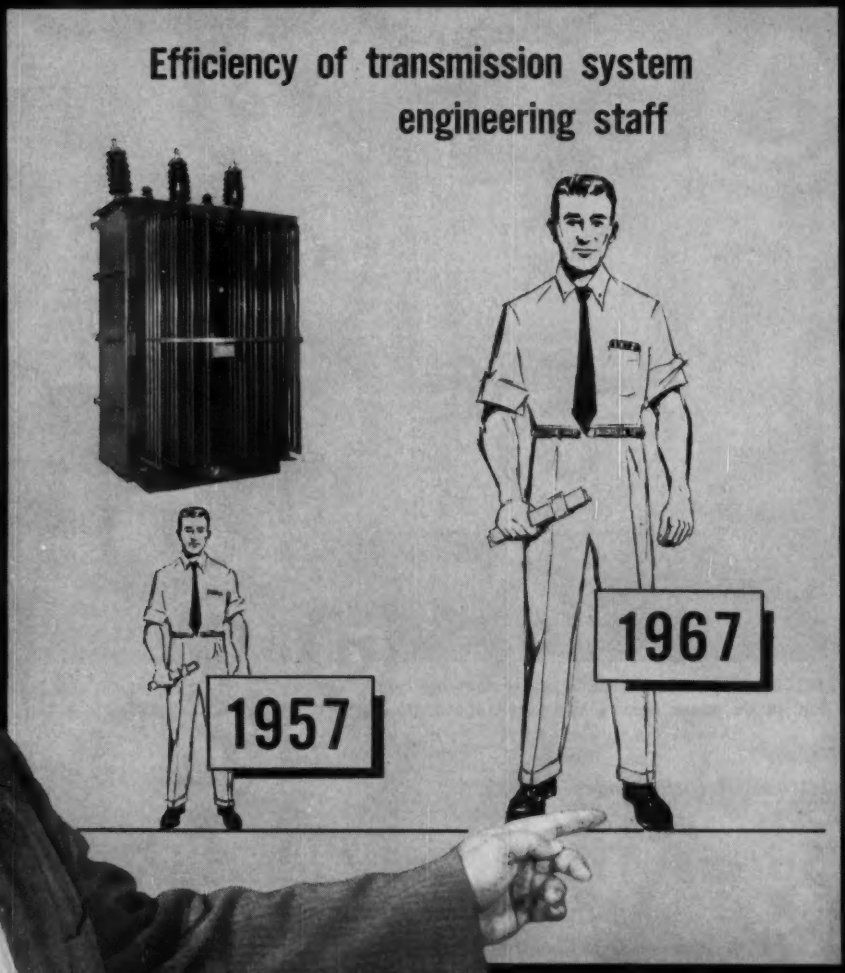
The truck visits an outlying location each evening after working hours. Cars and trucks are visually checked for low air pressure, flat tires, and burned out headlights. Minor driver complaints, such as faulty spark plugs, bad contacts, and similar troubles, are handled also at this time.

Vehicle lubrications and preventive maintenance inspections are not attempted on these visits. Vehicles are brought to the central repair garage for these and other major repairs.

Only Minor Repairs Are Made

Time required and cost of driving all vehicles to the central garage for all servicing requirements would be excessive and would frequently mean overtime pay for drivers. Were vehicles brought in at the end of the day it would involve battling the rush hour traffic. The practice of going to the sub-headquarters to service vehicles is, for these reasons, much more economical, and the special equipment on the service truck is an important factor in the operation.

(*More How To on page* 86)



DOUBLED EFFECTIVENESS of each transmission-system engineer by 1967! T. F. Volkmer, General Electric's Medium Transformer Department manager of engineering, predicts this manpower-economizing benefit as a result of full acceptance by utilities of standard-design medium transformers (501 to 7500 kva, 69 kv and below).

A GENERAL ELECTRIC 10-YEAR FORECAST:

Medium transformer standardization to double efficiency of transmission-system engineers

In 1967, electric utilities' transmission-system engineers will be largely relieved of medium-transformer design details; one man in this field will be as productive as are two today. Engineers will thus be freed for more challenging work, and utilities will be able to meet the future's heavier technical needs with fewer engineers than would otherwise be required. So forecasts T. F. Volkmer, manager of engineering at General Electric's Medium Transformer Department in Rome, Georgia.

What will make this greater productivity possible? This: utilities' continued acceptance and application of standard-design transformers. For, when standard-design units are adopted for all systems, only the most basic information (such as kva, high-voltage, and low-voltage ratings) will be needed to specify additional transformers. This simplified ordering procedure will relieve your valuable engineering personnel of time-consuming details of transformer design and specification.

YOU GET REAL BENEFITS TODAY!

You can realize the benefits of simplified ordering and reduced design time, *now,* by specifying General Electric RM (Repetitive Manufacture) transformers. These standard-design units also offer:

Faster shipment—Ten-week shipment is now average for General Electric RM medium transformers. This compares with an industry average of more than 16 weeks for specials.

More and better features—Standard design makes it economically possible for G.E. to offer such extras as Formex* insulated windings, control-center arrangement of instruments and accessories, reversible junction boxes, and many others.

Higher quality for longer life—G-E repetitive manufacture techniques permit 18 assembly-line tests and 22 quality-control inspections during manufacture, to assure dependable operation over a long service life.

G.E.'S BROAD RANGE OF STANDARDS HANDLES 90% OF ALL JOBS

If your company is not yet taking full advantage of the benefits of medium transformer standardization, act today. Ask your G-E Apparatus Sales Engineer to show you how G.E.'s broad range of standard RM medium transformers can meet the large bulk of your needs, and also work efficiently with older, special transformers now on your system. General Electric Co., Schenectady, N. Y. 416-11

*Reg. Trade-mark of General Electric Company

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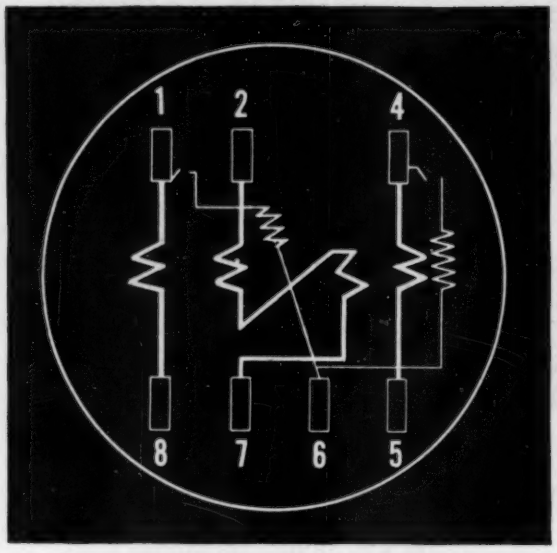
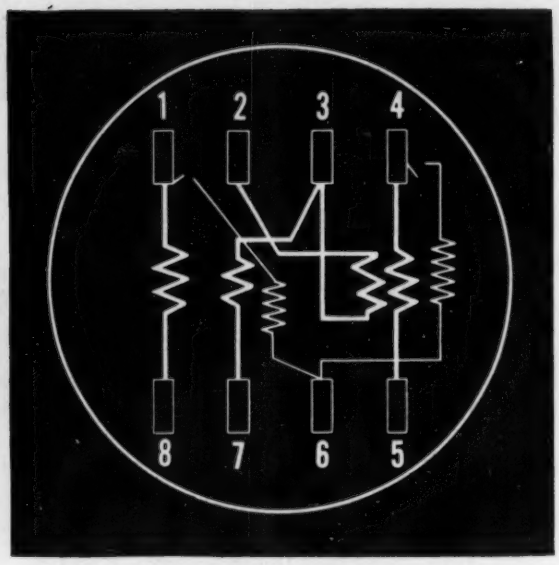


2-Stator 4-Wire Y Meter . . .



Coils Joined on Added Terminal . . .

Is Suitable for 4-Wire △ Socket

2-Stator Wye Meter Offers Flexibility

JAMES H. PATTON, Vice President, Sangamo Electric Co, Springfield, Ill.

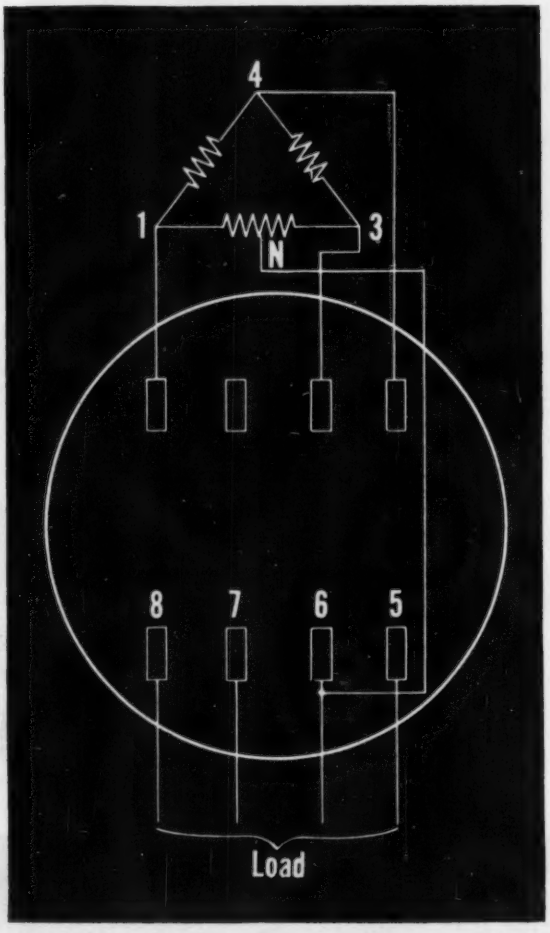
Simple modification of the present internal connections of the 2-stator watthour meter for 4-wire wye circuits equips it for use on 4-wire delta circuits as well. Such modification would allow utilities to use the same meter for 120/208-v wye and 120/240-v 4-wire delta services.

In essence, the change consists of bringing out the junction between the two current coils to an eighth terminal not usually in the wye-connected meter.

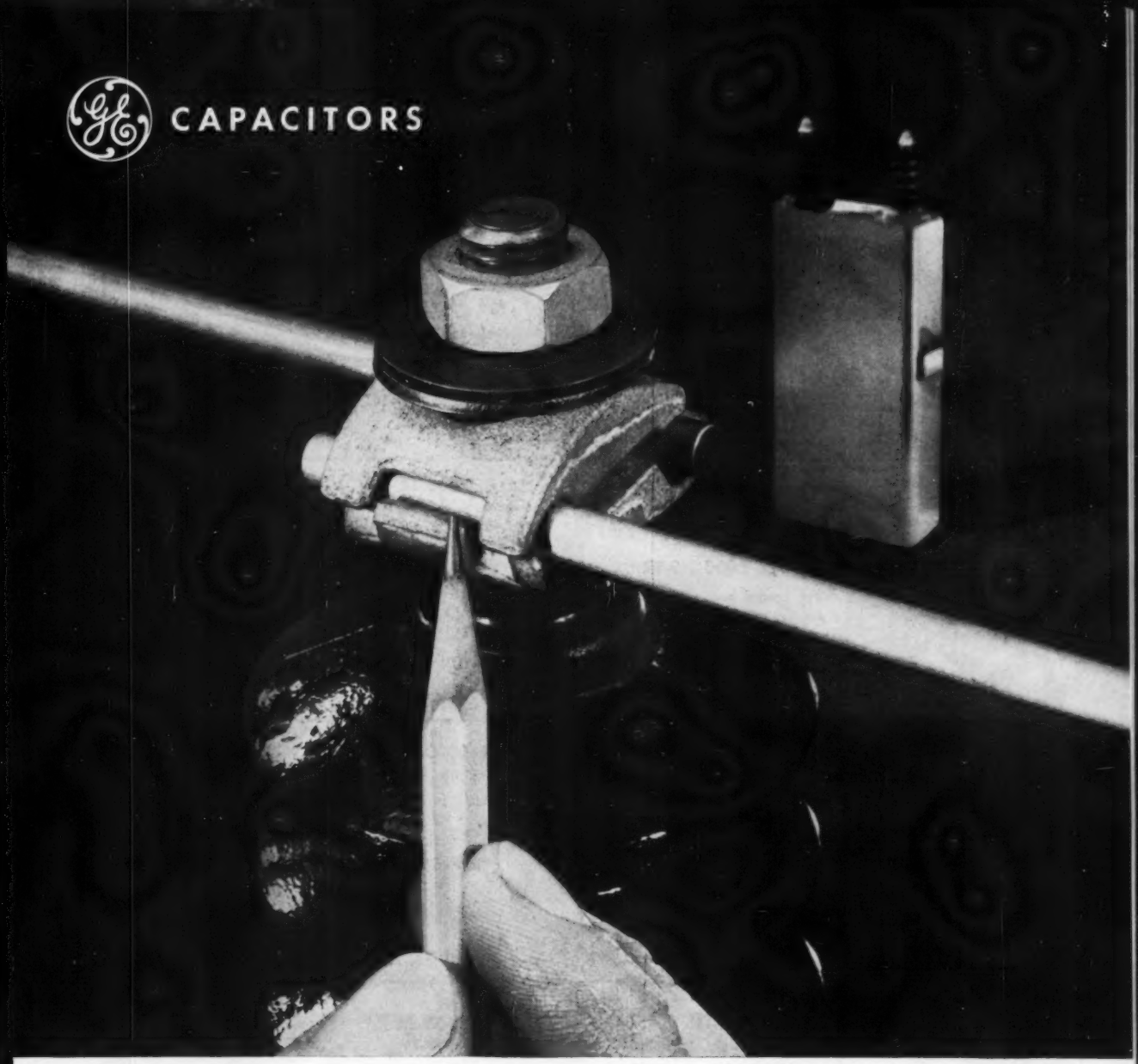
Use of the modified meter for delta service necessitates a change in socket wiring. The line usually connected in a 4-wire delta socket to terminal 2 would have to be connected to terminal 3. Meters originally calibrated for 4-wire wye service should be calibrated for 4-wire delta service with 208 v on the right-hand potential coil and 120 v on the left-hand potential coil.

The constant of this meter would have twice the value of the constant of a conventional 2-stator 3-wire meter of the same current and voltage rating. This would result in a speed which is only 75% of the speed of a conventional 2-stator 4-wire watthour meter with longer bearing life and better accuracy at extended load ranges.

Such modification is a step toward development of polyphase meters as proposed by C. V. Morey (EW, April 4, 1955, p. 74) and W. H. Farrington (EW, Jan. 21, 1957, p. 66).



CAPACITORS



Cold flow gets big squeeze

A capacitor terminal can't stop the cold flow of aluminum conductors, but it can adjust to it. The "big squeeze" provided by General Electric's terminal assembly does just that. Here's what happens.

No matter how the conductor shrinks, expands, or "flows," the jaws of the connector* bear down with a continuous quarter-ton grip. Cone-disk Belleville washers provide this firm, flexible, follow-up pressure that maintains full area contact and helps to keep out corrosion.

The result? No hot joints from corrosion or poor contact, even on switched capacitor banks with frequent thermal cycling. The big squeeze on cold flow is another Engineered Extra you get only with G-E capacitors.

Any questions? Your G-E Apparatus Sales Engineer can probably answer them. Or write to General Electric, Section 445–1, Schenectady 5, New York.

*General Electric's jumbo, parallel-groove connector, ideal for Al or Cu.

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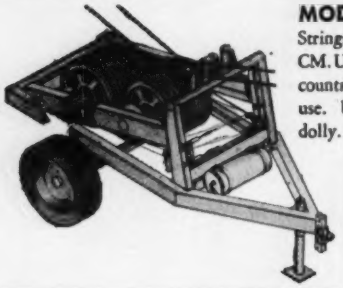
Partial showing of the now ***COMPLETE*** line of . . .

PENGO TENSION WIRE STRINGING EQUIPMENT

Manufactured by **PETERSEN ENGINEERING CO.,** ***Santa Clara, Calif.*** **14 Patents Pending**

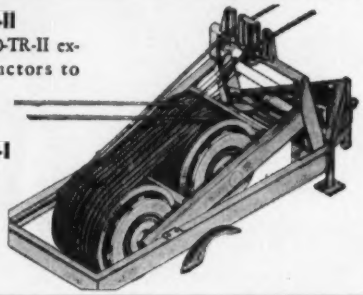


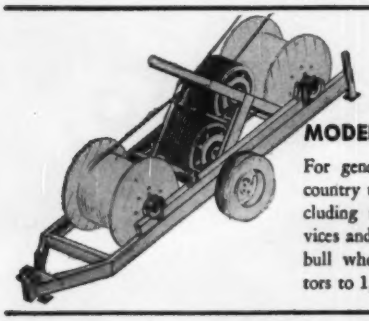
MODEL 5000-TR-II
Strings two conductors to 556,300 CM. Used primarily for very rough country work; also for general use. Use separate reel-carrying dolly.

MODEL 5000-TR-I
Similar except strings one conductor.

MODEL 6000-TR-II
Similar to Model 5000-TR-II except larger. Conductors to 1,272,000 CM.

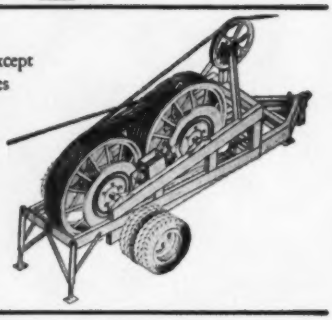
MODEL 6000-TR-I
Similar except for one conductor.

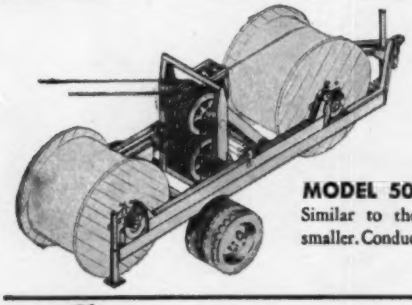




MODEL 6000-WS-TR
For general and medium rough country use. A complete unit including trailer, reel-carrying devices and its own double pair of bull wheels. Conductors to 1,272,000 CM.

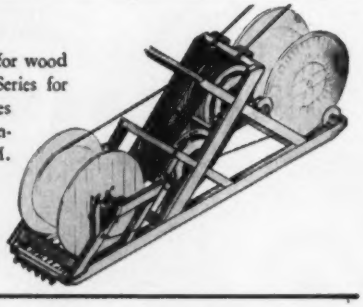
MODEL 7000-TR-I
Similar to model 6000-TR-I except larger. Conductors to 2 inches diameter.

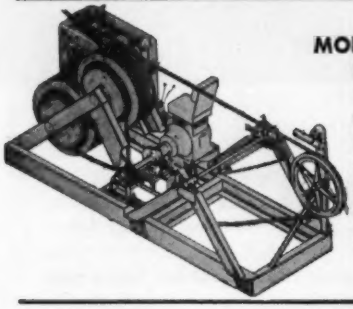




MODEL 5000-WS-TR
Similar to the 6000-WS-TR but smaller. Conductors to 556,300 CM.

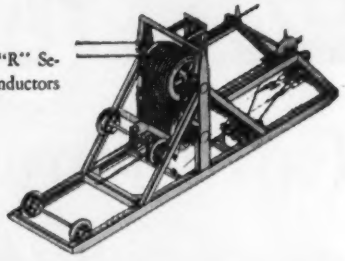
MODEL 6000-W
Available in "S" Series for wood or steel reels, in "R" Series for steel reels, or "SR" Series for trailer mounting. Conductors to 1,272,000 CM.

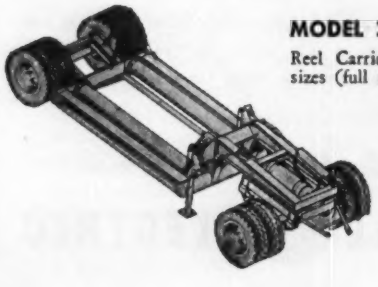




MODEL 6500
Bull Wheel Cable Puller. Available in "R" Series for steel reels, "S" Series for wood reels. Conductors to 1,272,000 CM. Also available in "LWR" Model for extra-large steel reels. Model 5500 similar (smaller).

MODEL 5000-SR
Available in "S" Series, "R" Series, or "SR" Series. Conductors to 556,300 CM.





MODEL 7500
Reel Carrier. Takes the largest sizes (full range) of steel reels. Loads and unloads with one man. No auxiliary equipment needed except the truck that pulls it. For use with any one of the tensioning machines shown on this page.

ADDITIONAL MODELS NOT SHOWN

Tension Reel Trailers

MODELS 2, 3, and 4, Two-Wheel Straddle Dollies not shown. For use with any one of the tensioning machines shown on these pages.

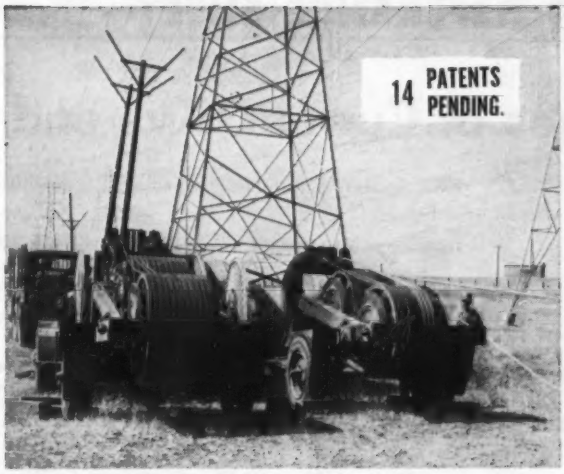
Tension Stringers

MODELS 6000-SK-I and 6000-SK-II For one or two conductors to 1,272,000 CM. Skid mounted for installation on owner's equipment.

MODELS 5000-SK-I and 5000-SK-II Skid mounted for installing on owner's equipment. For stringing one or two conductors to 556,300 CM.

MODEL 5000-WS-III Strings three conductors to 556,300 CM. For mounting on low-bed or full trailer.

MODEL 6000-WS-III Strings three conductors to 1,272,000 CM. For mounting on low-bed or full trailer.



Two PENGO model 6000 TR-II wire tensioners being used by Pacific Gas and Electric Co. in reconductoring job between Vacaville, Calif. and Cottonwood, Calif. 285 miles of 500 MCM copper is being replaced by 954 MCM aluminum in this operation.

Newest method of stringing overhead lines

Two PENGO model 6500 Bullwheel Cable Pullers used by Pacific Gas and Electric Co. for pulling in the new line on the job mentioned above. Unit, manned by an operator and one reel tender, pulls the pulling line (in this instance the old copper conductor) over the double neoprene lined Bullwheels and winds it for shipment in a single operation.

- ***Safest, most economical way of stringing transmission, distribution and even secondary lines.***
- ***Its greatest savings are effected when stringing over and through energized circuits . . . by far the safest, too!***
- ***14 Patents pending!***

Smooth, positive control of conductor tension can be maintained at all times regardless of model or size of PENGO tensioning equipment used. The large, specially designed PENGO disc brakes are mounted away from the Bullwheels to assure dissipation of the heat generated by the continuous braking action and prevent transmission of the heat to the Bullwheels.

Note the wide range of models on the opposite page available for all types of jobs or terrain and for all sizes of conductor.

List your requirements and send for descriptive literature and prices.

Made by the makers of the World-Famous
PENGO EARTH AUGERS

PETERSEN
ENGINEERING COMPANY
Santa Clara, Calif.

PETERSEN ENGINEERING CO.
Santa Clara, California Dept. 4

Please send me more information on the new Pengo wire stringing equipment.

Name_____

Firm_____

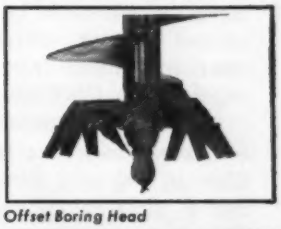
Address_____

City_____ State_____

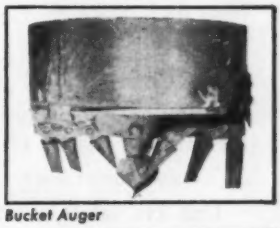
Other PENGO Products include:

24 inch Heavy Duty Flight Auger

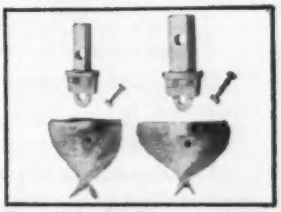
Double-Helix Heavy Duty Auger



Offset Boring Head

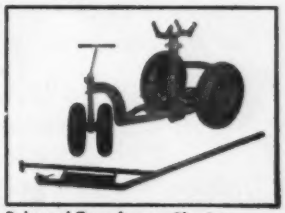


Bucket Auger



Screw Bit for Small Diameter Holes

Pulling Eye



Pole and Transformer Chariot

Unit Values of Current, Kva and Their Vector

FRED C. DeWEESE, Consulting Engineer,
Raleigh, North Carolina

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Unit values in this table are on 3-phase, 60-cycle basis and have a wide range of application. The ta-

Explanation of the Table

Cos θ, column (1), represents the power factor of the circuit, expressed as a decimal, at intervals as shown. Sin θ, column (2), represents the corresponding reactive factor. The θ values, column (3), represents the angle by which the current lags the voltage, read to the nearest minute from a table of trigonometric functions.

Unit current in amperes, column (4), corresponds to a load of one kilowatt, 100 volts, three-phase, 60 cycles; these values were derived from the expression:

$$\text{Amperes} = \frac{1{,}000 \text{ watts}}{\text{volts} \times \sqrt{3} \times \text{pf}}$$

Quadrature components, or vector amperes, column (5),

$$= \text{unit current } (\cos\theta - j \sin\theta)$$

Unit kva values, column (6),

$$= \text{volts} \times \sqrt{3} \times \text{unit current}$$

where volt $\times \sqrt{3} = 173.205$

Quadrature components of kva, column (7),

$$= \text{unit kva } (\cos\theta - j \sin\theta)$$

All table values of power factor, except unity, are lagging; all j quantities are minus. At leading power factors the current and kva will have the same numerical values as at corresponding lagging power factors, but the j quantities will be plus. (See footnote to table).

Cos θ	Sin θ	θ	Amperes	Components of Current	Kva	Components of Kva
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0.500	0.8660	60° 00′	11.5470	5.7735−j10.0000	2.0000	1−j1.7320
.505	.8631	59° 40′	11.4327	5.7735−j 9.8676	1.9801	1−j1.7090
.510	.8620	59° 20′	11.3206	5.7735−j 9.7377	1.9608	1..j1.6902
.515	.8572	59° 00′	11.2106	5.7735−j 9.6097	1.9417	1−j1.6644
.520	.8542	58° 40′	11.1029	5.7735−j 9.4837	1.9231	1−j1.6427
0.525	0.8511	58° 20′	10.9971	5.7735−j9.3596	1.9046	1−j1.6210
.530	.8480	58° 00′	10.8934	5.7735−j9.2376	1.8868	1−j1.6000
.535	.8446	57° 39′	10.7916	5.7735−j9.1167	1.8591	1−j1.5790
.540	.8417	57° 19′	10.6917	5.7735−j8.9992	1.8519	1−j1.5587
.545	.8382	56° 58′	10.5936	5.7735−j8.8796	1.8349	1−j1.5380
0.550	0.8352	56° 38′	10.4973	5.7735−j8.7673	1.8182	1−j1.5129
.555	.8318	56° 17′	10.4027	5.7735−j8.6530	1.8018	1−j1.4987
.560	.8285	55° 57′	10.3096	5.7735−j8.5417	1.7857	1−j1.4795
.565	.8251	55° 36′	10.2186	5.7735−j8.4314	1.7699	1−j1.4603
.570	.8216	55° 15′	10.1289	5.7735−j8.3219	1.7544	1−j1.4414
0.575	0.8180	54° 54′	10.0409	5.7735−j8.2135	1.7391	1−j1.4226
.580	.8146	54° 33′	9.9543	5.7735−j8.1088	1.7241	1−j1.4045
.585	.8111	54° 12′	9.8692	5.7735−j8.0049	1.7094	1−j1.3865
.590	.8074	53° 51′	9.7856	5.7735−j7.9009	1.6949	1−j1.3685
.595	.8037	53° 29′	9.7034	5.7735−j7.7986	1.6807	1−j1.3508
0.600	0.8000	53° 08′	9.6225	5.7735−j7.6980	1.6667	1−j1.3333
.605	.6962	52° 46′	9.5430	5.7735−j7.5981	1.6529	1−j1.3160
.610	.7929	52° 25′	9.4648	5.7735−j7.4999	1.6394	1−j1.2990
.615	.7885	52° 03′	9.3878	5.7735−j7.4023	1.6260	1−j1.2821
.620	.7846	51° 41′	9.3121	5.7735−j7.3063	1.6219	1−j1.2656
0.625	0.7806	51° 19′	9.2376	5.7735−j7.2109	1.6000	1−j1.2490
.630	.7766	50° 57′	9.1643	5.7735−j7.1170	1.5873	1−j1.2327
.635	.7725	50° 35′	9.0921	5.7735−j7.0236	1.5748	1−j1.2165
.640	.7684	50° 13′	9.0211	5.7735−j6.9318	1.5625	1−j1.2006
.645	.7357	49° 50′	8.9512	5.7735−j6.7644	1.5504	1−j1.1716
0.650	0.7599	49° 28′	8.8824	5.7735−j6.7497	1.5385	1−j1.1691
.655	.7556	49° 05′	8.8145	5.7735−j6.6602	1.5269	1−j1.1536
.660	.7513	48° 42′	8.7477	5.7735−j6.5721	1.5151	1−j1.1383
.665	.7468	48° 19′	8.6820	5.7735−j6.4837	1.5038	1−j1.1230
.670	.7429	47° 56′	8.6172	5.7735−j6.3974	1.4925	1−j1.1081
0.675	0.7379	47° 33′	8.5533	5.7735−j6.3116	1.4815	1−j1.0932
.680	.7332	47° 09′	8.4904	5.7735−j6.2252	1.4706	1−j1.0782
.685	.7286	46° 46′	8.4285	5.7735−j6.1410	1.4599	1−j1.0637
.690	.7238	46° 22′	8.3674	5.7735−j6.0563	1.4493	1−j1.0490
.695	.7189	45° 58′	8.3072	5.7735−j5.9720	1.4388	1−j1.0344
0.700	0.7141	45° 34′	8.2479	5.7735−j5.8898	1.4286	1−j1.0202
.705	.7092	45° 10′	8.1894	5.7735−j5.8080	1.4184	1−j1.0060
.710	.7042	44° 42′	8.1317	5.7735−j5.7265	1.4084	1−j0.9919
.715	.6991	44° 21′	8.0748	5.7735−j5.6541	1.3986	1−j0.9779
.720	.6940	43° 57′	8.0188	5.7735−j5.5650	1.3889	1−j0.9639
0.725	0.6887	43° 32′	7.9634	5.7735−j5.4844	1.3793	1−j0.9499
.730	.6834	43° 07′	7.9089	5.7735−j5.4049	1.3699	1−j0.9362
.735	.6782	42° 42′	7.8551	5.7735−j5.3273	1.3605	1−j0.9227
.740	.6726	42° 16′	7.8020	5.7735−j5.2477	1.3613	1−j0.9089
.745	.6670	41° 50′	7.7497	5.7735−j5.1690	1.3423	1−j0.8953
0.750	0.6614	41° 25′	7.6980	5.7735−j5.0918	1.3333	1−j0.8819
.755	.6556	40° 58′	7.6470	5.7735−j5.0134	1.3245	1−j0.8683
.760	.6499	40° 32′	7.5967	5.7735−j4.9371	1.3158	1−j0.8551
.765	.6441	40° 06′	7.5471	5.7735−j4.8611	1.3072	1−j0.8420
.770	.6380	39° 39′	7.4981	5.7735−j4.7838	1.2987	1−j0.8286

Relations for 1 Kw, 100V, at Various PF

ble makes available material from which to determine, quickly and accurately, over-all load conditions from unit values on a purely ratio basis, and only a slide rule is required for the purpose.

Cos θ	Sin θ	θ	Amperes	Components of Current	Kva	Components Kva
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0.775	0.6320	39° 12′	7.4497	5.7735−*j*4.7082	1.2903	1−*j*0.8155
.780	.6258	38° 44′	7.4019	5.7735−*j*4.6321	1.2820	1−*j*0.8023
.785	.6195	38° 17′	7.3548	5.7735−*j*4.5566	1.2739	1−*j*0.7892
.790	.6131	37° 49′	7.3082	5.7735−*j*4.4807	1.2658	1−*j*0.7761
.795	.6066	37° 21′	7.2623	5.7735−*j*4.4053	1.2579	1−*j*0.7630
0.800	0.6000	36° 52′	7.2170	5.7735−*j*4.3302	1.2500	1−*j*0.7500
.805	.5933	36° 23′	7.1720	5.7735−*j*4.2549	1.2422	1−*j*0.7370
.810	.5864	35° 54′	7.1278	5.7735−*j*4.1799	1.2346	1−*j*0.7240
.815	.5795	35° 25′	7.0841	5.7735−*j*4.1049	1.2270	1−*j*0.7110
.820	.5724	34° 55′	7.0409	5.7735−*j*4.0299	1.2195	1−*j*0.6980
0.825	0.5651	34° 25′	6.9982	5.7735−*j*3.9549	1.2121	1−*j*0.6850
.830	.5578	33° 54′	6.9560	5.7735−*j*3.8798	1.2048	1−*j*0.6720
.835	.5503	33° 23′	6.9144	5.7735−*j*3.8046	1.1976	1−*j*0.6590
.840	.5426	32° 52′	6.8732	5.7735−*j*3.7294	1.1905	1−*j*0.6459
.845	.5348	32° 20′	6.8325	5.7735−*j*3.6538	1.1834	1−*j*0.6329
0.850	0.5268	31° 47′	6.7924	5.7735−*j*3.5782	1.1765	1−*j*0.6198
.855	.5186	31° 14′	6.7526	5.7735−*j*3.5021	1.1696	1−*j*0.6066
.860	.5103	30° 41′	6.7134	5.7735−*j*3.4258	1.1628	1−*j*0.5934
.865	.5018	30° 07′	6.6746	5.7735−*j*3.3491	1.1561	1−*j*0.5801
.870	.4931	29° 33′	6.6362	5.7735−*j*3.2723	1.1494	1−*j*0.5668
0.875	0.4841	28° 57′	6.5983	5.7735−*j*3.1941	1.1429	1−*j*0.5533
.880	.4749	28° 21′	6.5608	5.7735−*j*3.1155	1.1364	1−*j*0.5396
.885	.4656	27° 45′	6.5237	5.7735−*j*3.0375	1.1299	1−*j*0.5261
.890	.4560	27° 08′	6.4871	5.7735−*j*2.9578	1.1236	1−*j*0.5123
.895	.4461	26° 29′	6.4508	5.7735−*j*2.8778	1.1173	1−*j*0.4984
0.900	0.4358	25° 51′	6.4150	5.7735−*j*2.7953	1.1111	1−*j*0.4842
.905	.4254	25° 11′	6.3796	5.7735−*j*2.7139	1.1050	1−*j*0.4701
.910	.4144	24° 30′	6.3445	5.7735−*j*2.6924	1.0989	1−*j*0.4554
.915	.4035	23° 48′	6.3098	5.7735−*j*2.5457	1.0929	1−*j*0.4409
.920	.3918	23° 04′	6.2755	5.7735−*j*2.4588	1.0870	1−*j*0.4259
0.925	0.3800	22° 20′	6.2416	5.7735−*j*2.3718	1.0811	1−*j*0.4108
.930	.3678	21° 34′	6.2081	5.7735−*j*2.2820	1.0753	1−*j*0.3952
.935	.3547	20° 46′	6.1748	5.7735−*j*2.1899	1.0695	1−*j*0.3793
.940	.3409	19° 57′	6.1420	5.7735−*j*2.0940	1.0638	1−*j*0.3627
.945	.3271	19° 05′	6.1095	5.7735−*j*1.9282	1.0582	1−*j*0.3461
0.950	0.3122	18° 12′	6.0774	5.7735−*j*1.8977	1.0526	1−*j*0.3287
.955	.2966	17° 15′	6.0456	5.7735−*j*1.7931	1.0471	1−*j*0.3108
.960	.2800	16° 16′	6.0141	5.7735−*j*0.6839	1.0417	1−*j*0.2917
.965	.2623	15° 12′	5.9829	5.7735−*j*1.5690	1.0363	1−*j*0.2718
.970	.2431	14° 04′	5.9521	5.7735−*j*1.4466	1.0309	1−*j*0.2506
0.975	0.2224	12° 51′	5.9215	5.7735−*j*1.3166	1.0256	1−*j*0.2281
.980	.1990	11° 29′	5.8913	5.7735−*j*1.1724	1.0204	1−*j*0.2031
.985	.1726	9° 56′	5.8614	5.7735−*j*1.0114	1.0152	1−*j*0.1752
.990	.1411	8° 06′	5.8318	5.7735−*j*0.8227	1.0100	1−*j*0.1425
.995	.0999	5° 44′	5.8025	5.7735−*j*0.5797	1.0050	1−*j*0.1004
0.996	0.0894	5° 08′	5.7967	5.7735−*j*0.5180	1.0040	1−*j*0.0897
.997	.0774	4° 26′	5.7908	5.7735−*j*0.4482	1.0030	1−*j*0.0776
.998	.0632	3° 37′	5.7851	5.7735−*j*0.3657	1.0020	1−*j*0.0633
.999	.0447	2° 34′	5.7793	5.7735−*j*0.2584	1.0010	1−*j*0.0448
.9995	.0316	1° 49′	5.7764	5.7735−*j*0.1826	1.0005	1−*j*0.0316
1.0000	.0000	0° 00′	5.7735	5.7735−*j*0.0000	1.0000	1−*j*0.0000

Cos θ = power factor. Sin θ = reactive factor. θ = pf angle.
Sin $\theta = \sqrt{(1 - \cos^2\theta)}$. At leading power factors the sign of the *j* quantity is plus.

How to Use the Table

Three examples outline the use of the tabular values of unit current and unit kva:

1. Find the current for a load of 500 kw at 22,000 v and 0.75 pf. Multiply the kw by the unit current for the respective power factor and divide by E/100, where E represents the phase-to-phase voltage. From table (0.75 pf) unit current = 7.698 amp; then

$$I = (500 \times 7.698)/220 = 17.5 \text{ amp}$$

2. Find the load at a given voltage and power factor. Multiply the unit kva for the respective power factor by E/100, where E represents the phase-to-phase voltage. For example, 22,000 v, 0.75 pf. From table (0.75 pf) unit kva = 1.3333; then

$$220 \times 1.3333 = 293 \text{ kva.}$$

Check:

$$293 \times 17.5/7.698 \times 0.75 = 500 \text{ kw,}$$

as above.

3. Find the power factor and total kva load for a load of 30,000 kw and a current reading of 164 amp at 132,000 v. Since the table values are based on one kw at 100 v, 132,000 v is equivalent to 1320 kw, from which:

$$\text{Unit Current} = \frac{1320 \times 164}{30{,}000} = 7.217 \text{ amp}$$

From column (4) at 7.217 amp, the power factor is 0.8

From column (2) the sin θ is 0.6, then:

$$7.217(0.8 - j0.6) = 5.7735 - j4.3302$$

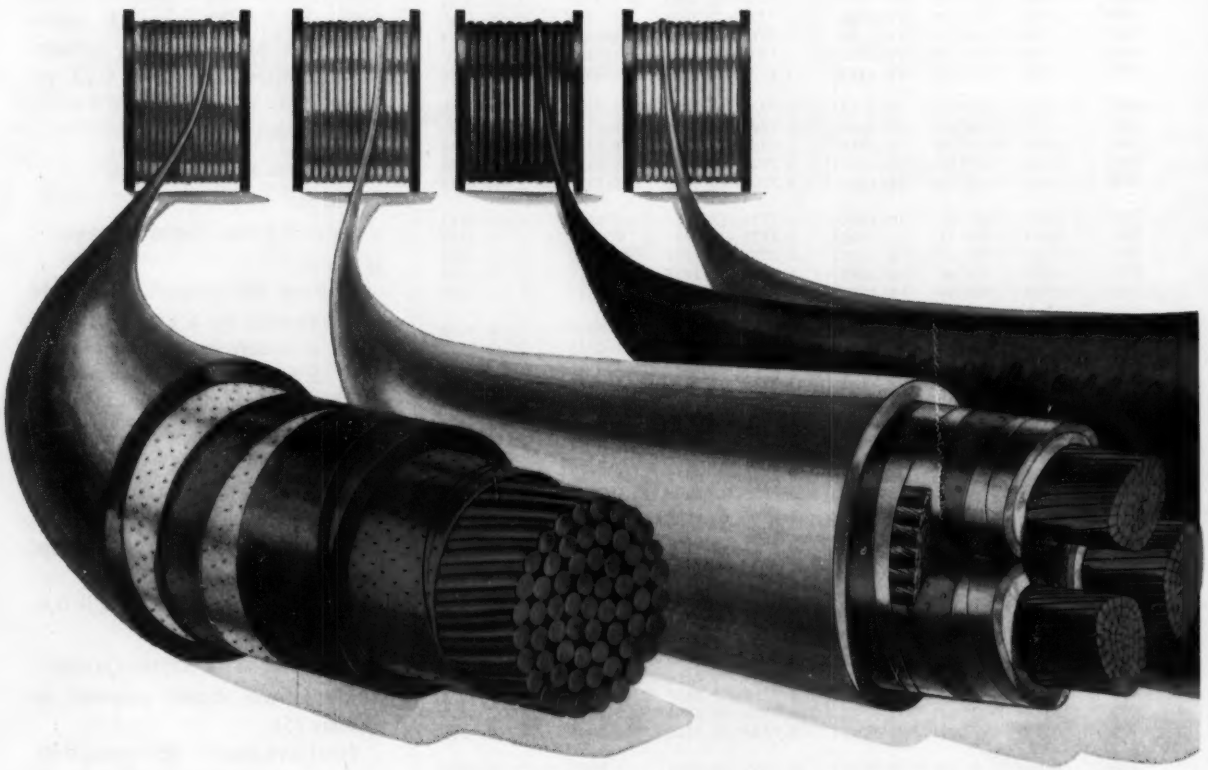
which is the vector amperes in column (5).

Total kva load is deteremined by using the quadrature component in column (7), thus:

$$30{,}000(1 - j0.75) = 30{,}000 - j22{,}500$$
$$= 37.500 \text{ kva.}$$

FOR THE MOST EFFICIENT
POWER DISTRIBUTION . . . SPECIFY

PAPER-INSULATED CABLES BY PHELPS



Single conductor, 1 KV to 15 KV

Three-conductor, 1 KV to 15 KV

DODGE!

Phelps Dodge paper-insulated power cables have a *demonstrated record* of long life in a great variety of designs for all types of applications—underground duct, direct burial, submarine and aerial.

Paper-insulated cables have these important inherent characteristics that improve operating performance and lengthen service life:

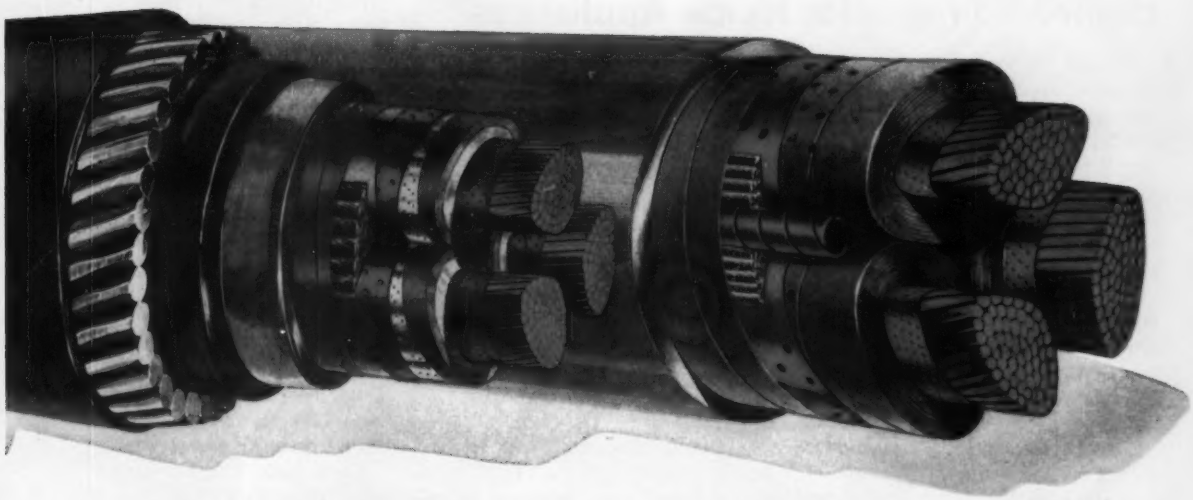
- Extra high 60-cycle and impulse strength to withstand switching and lightning surges.
- Ability to handle large blocks of power in single cables of minimum dimensions.
- Positive protection against all contaminations, due to being hermetically sealed in an extruded metallic sheath.

Paper-insulated cables can be supplied with either lead or aluminum sheaths.

Phelps Dodge offers the widest range of high voltage cables to the electrical industry.

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, NEW YORK



Submarine, 1 KV to 15 KV

Low-Pressure gas-filled, 8 KV to 15 KV

Survey Pegs Appliance Dealer '57 Headaches

Big woes are still price-cutting, whopping trade-ins. In 1957, profits will remain about the same; operating costs are likely to be reduced

The problems of price-cutting, discount houses and excessive trade-in allowances are still the big ones plagueing appliance retailers, according to the Eleventh Annual Cost-of-Doing Business Survey of the National Appliance and Radio-TV Dealers Association.

The survey, published recently by NARDA News, covers 1956. However, many of last year's big problems are this year's also. Survey reveals dealers look forward to:

- Price cutting
- Lower manufacturers and distributor discounts
- Trade-in pressures
- Manufacturers and distributors selling to builders
- Tight money
- Shortage of good salesmen
- Overproduction

Product line sales prospects vary, too, for '57. Here's the way a majority of dealers think they'll stack up: (1) Laundry equipment (including all washers and dryers); (2) Television; (3) Refrigerators; (4) Air conditioners; (5) Built-ins; (6) Hi-fi phonographs; (7) Radios; and (8) Color TV.

Fifty nine per cent of the reporting dealers made a profit forecast for 1957. Of this group:

- 46% expect profits to jump an average of 11% of 1956.
- 11% see a profit drop of averaging 10%.
- 43% think profits will be about the same as '56.

But, the survey goes on, dealers are not just sitting back and taking it. Dealer counterattacks include emphasizing certain product lines. In order, these are Hi-fi's, air conditioners, kitchen equipment (built-in's), dishwashers, freezers, furniture, de-humifiers, color TV, and disposal units.

New help doesn't seem to be one of their weapons. Only 31% said they plan to hire additional salespeople. But they may make some definite moves regarding appliance service. Dealer emphasis here is, and will be, on Hi-fi's and heating equipment.

"Reducing operating costs" led the list of dealer answers to "What economies are you affecting in your business this year?" Cuts are coming in advertising, service and personnel. Some tightening of credit was mentioned, as was "improved methods of inventory control" and "remodelling."

Big Question at NEMA Appliance Meeting:

Higher Voltages for Home Appliances?

Higher utilization voltages for electrical appliances placed high on the agenda for discussion at the annual meeting of NEMA's Major Appliance Division in Hot Springs, Va., last month. The problem was reviewed by L. D. Price, manager, NEMA Engineering and Safety Regulation Department.

Heart of the matter is the ever-increasing residential load, and the power companies' dilemma of providing service for it over existing secondary distribution facilities. It has been proposed that this might be done with an increase in voltage with a resultant one in capacity.

Present level is 120 v, with some appliances, operating on 240 v, namely, ranges, water heaters, automatic washers and dryers. Just what levels these would go to is a question. Assuming all safety and technical problems could be solved, 240/480 and 277/480 are among the higher voltages mentioned.

NEMA, EEI on It Now

Both EEI and NEMA, through a a joint committee, are grappling with the problem now. If any agreement is reached, standardization would be in order. According to Price, "If higher voltages are used, it is essential that, if possible that a single system be standardized."

Thinking concerning higher residential distribution voltages grew out of (1) industry forecasts showing how greatly the residential demand is expected to increase with population and new appliances, and (2) the war-time copper and distribution equipment economies affected in industrial plant by supplying lighting from 3-phase, 4 wire, 480-v power circuits.

EEI Bares Range Push

"Cook Better. . . . Electrically" brands the theme of EEI's Fall Range Campaign according to E. J. Hurley, Chairman of the Residential Promotion Committee, and Director of Residential & Rural Sales, Detroit Edison Co.

Featuring colorful displays, the locally coordinated electric range campaign will run the months of September, October, and November. Advantages of cooking electrically are shown in sales aids.

Eight piece kits for window and store display and a set of five standup point-of purchase pieces describe the CBE story.

(*More Selling on page* 98)

Your Westinghouse representative can prove...

YOU GAIN 12"-17" HOT LINE CLEARANCE

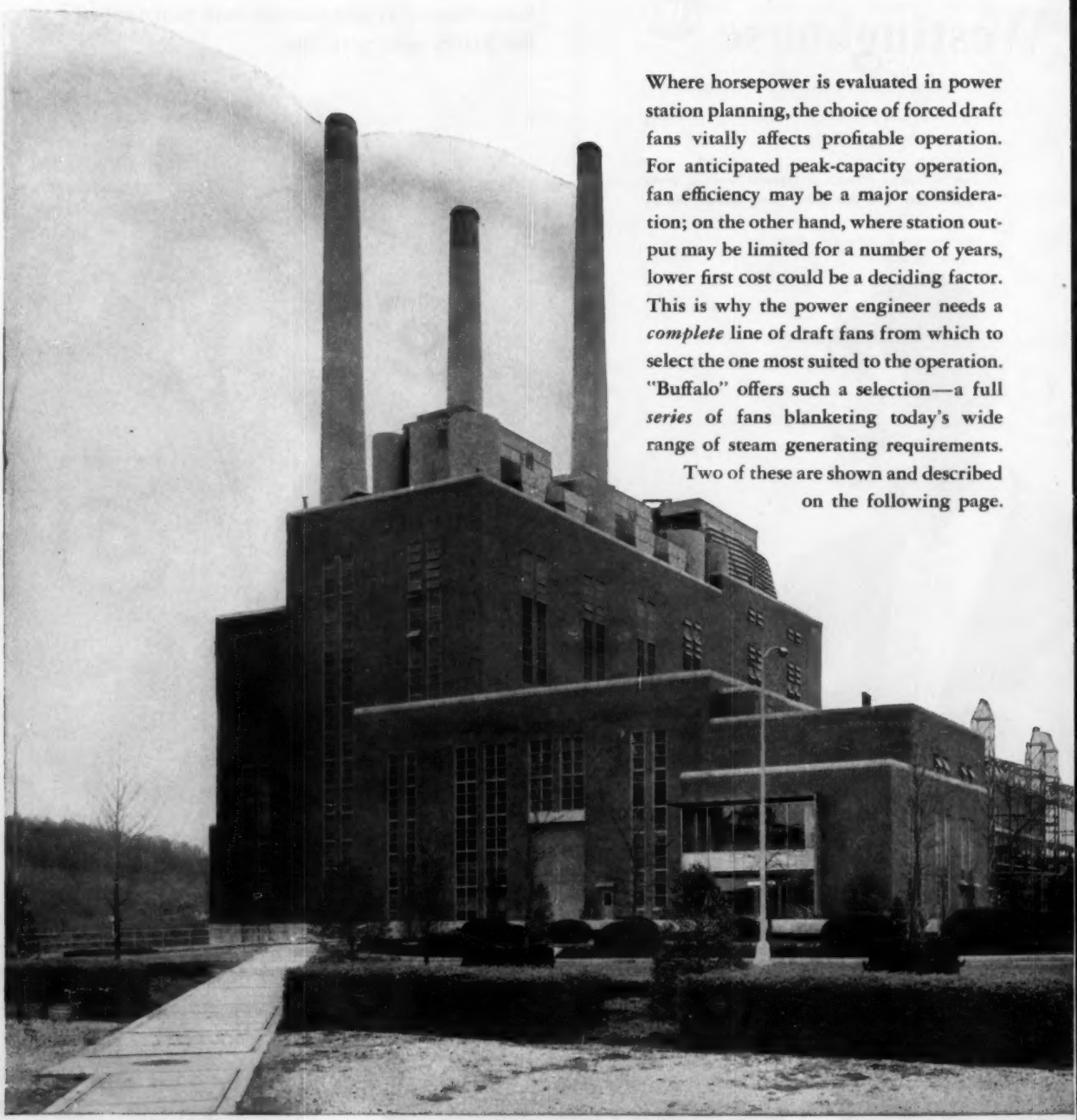
and eliminate pinched fingers with new, exclusive Westinghouse eyebolt, I-beam mounting (3-50 kva). Forged steel eyebolt seated in forged steel I-beam. Tensile strength is independent of cover. Every transformer is production-line pull-tested for 200% safety factor.

YOU CAN BE SURE...IF IT'S

Westinghouse

Jack McQuillan, Director of General Services, West Penn Power, and Don Burns, Westinghouse representative. "The eyebolt construction is a major safety improvement in pole-type distribution transformers" ... Mr. McQuillan. J-70792

WHERE HORSEPOWER IS EVALUATED



Where horsepower is evaluated in power station planning, the choice of forced draft fans vitally affects profitable operation. For anticipated peak-capacity operation, fan efficiency may be a major consideration; on the other hand, where station output may be limited for a number of years, lower first cost could be a deciding factor. This is why the power engineer needs a *complete* line of draft fans from which to select the one most suited to the operation. "Buffalo" offers such a selection—a full *series* of fans blanketing today's wide range of steam generating requirements.

Two of these are shown and described on the following page.

—THESE "BUFFALO" DRAFT FANS
OFFER IMPORTANT ADVANTAGES

High Efficiency Over a Broad Range—Type "BLH" F. D. Fan

This backward-curve fan is providing performance characteristics highly desirable for many stations. Designed for Classes II-IV operation (system pressures above 3¾"), its mechanical efficiency is above 80% over a very broad range, providing flexibility over wide load variations. Its complete streamlining includes the proven inlet bell, directional inlet vanes, backward curve blades, wheel-suited housing and divergent outlet — features offered exclusively by "Buffalo". Like the "Buffalo" Airfoil Fans, the "BLH" is used efficiently with "Buffalo" Variable Inlet Vane volume control. Write for Bulletin F-200.

Maximum Efficiency for Specific Operating Conditions— Type "BA" Airfoil F. D. Fan

"Buffalo" Airfoil Fans offer mechanical efficiency up to 92%, and are available with a choice of three wheels to match widely varying pressure requirements. These fans have extra-wide blades for a deep "bite" — extremely good inlet conditions, thanks to the smooth inlet bell and matching curved wheel flange — plus excellent static conversion thru the unique new "Buffalo" divergent outlet. Available with "Buffalo" Variable Inlet vanes — which do not reduce performance — for volume control. Write for Bulletin FD-106 for full details.

In every "Buffalo" product is the "Q" Factor, or built-in Quality which provides trouble-free satisfaction and long life.

BUFFALO FORGE COMPANY
BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
FORCED DRAFT COOLING HEATING PRESSURE BLOWING

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

FPC Boosts A.C. With 'Weather by Wire'

Florida utility helps dealers sell both heat pumps and conventional A. C. with advertising and technical support

Florida Power Corp's "Weather by Wire" air conditioning promotion is now in full swing. Featuring both heat pumps and conventional air conditioning systems, "Weather by Wire" has been designed to help dealers in FPC's area sell 5,000 tons of air conditioning during the summer.

The promotion to date is going over well. One big reason: the utility's gimmick—a $1.00 bonus to dealers and their salesmen for every ton of residential air conditioning equipment sold.

To help the promotion in other ways, Florida Power is featuring air conditioning in its newspaper, radio and television advertising. Window displays also tie-in the "Weather by Wire" theme. In addition, the company's residential sales representatives and home service people will help tell the A.C. story.

Technical problems the dealers run into will get solved with the help of FPC's air conditioning department. Customers, of course, get the same service. Company does this free.

C. W. Ailstock, director of residential development, expects great things from "Weather by Wire." According to Ailstock, "Electric air conditioning is playing an ever increasing role in comfortable Florida living. This fact, combined with the usual fine support of our dealers and our own sales people, should put the 'Weather by Wire' campaign over the top, and make June and July the best air conditioning sales months we have ever had."

COMPETITOR'S CORNER

AGA: 8½% Gas Heat Gain in 1956-57

The gas utility industry added an estimated 1,300,000 consumers during the 1956-57 heating season, according to American Gas Association in a recent issue of Gas Age. This, says AGA, boosts its total of gas househeating customers to 16.7 million, for an 8½% gain over the previous year. The Association predicts the figure will go to nearly 20½ million by the end of 1959.

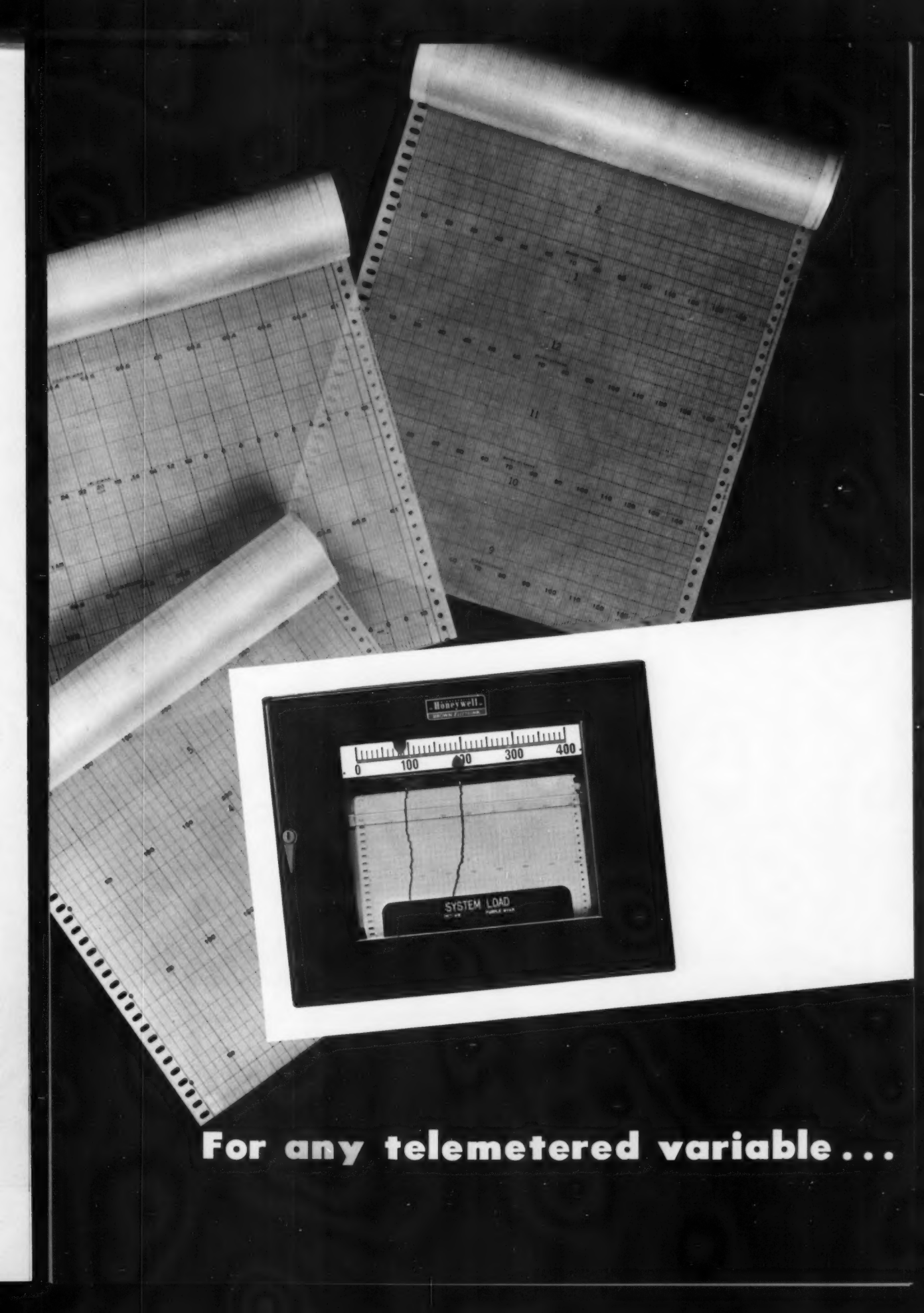
Gas househeating customers, reports AGA, represent 60% of all residential gas consumers and 71% of all residential users are considered to be part of the potential gas househeating market.

Conversions are expected to play a big part in gas' projected growth for the next three years. Existing dwelling units, through conversion from other types of fuel, will account for 40% of the anticipated 3.7 million new gas customers.

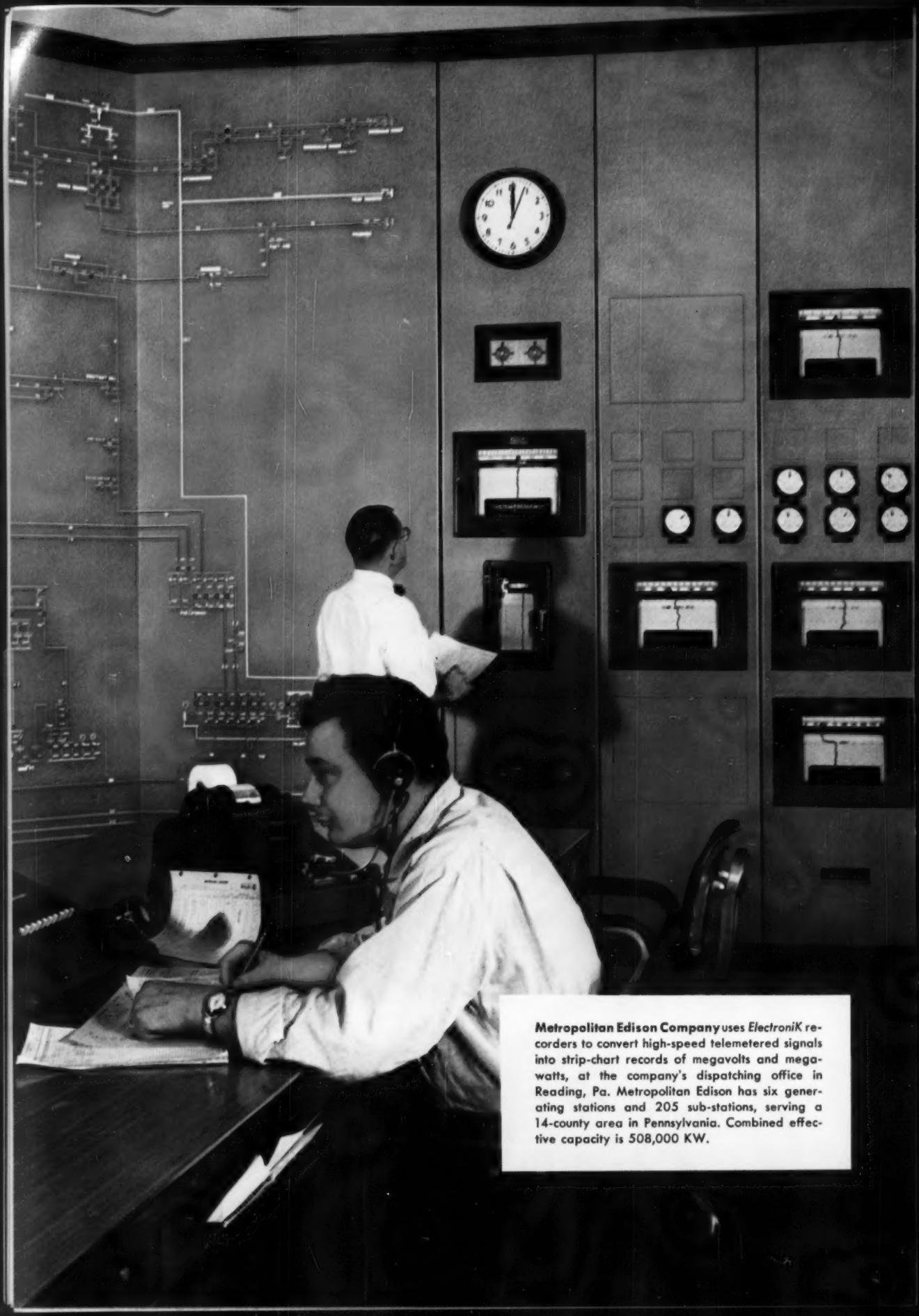
Most significant gains are expected for the east north central region of the U. S., where gas hopes to add 930,000 new units. Next will be the Pacific region with an increase of approximately 658,000. Third is the Middle Atlantic States, in which gas figures it will put another 542,000 units, and fourth comes South Central region with 410,000. California looks like the best single state prospect, with an expected 563,000 dwellings units for an 86% hunk of the Pacific region's market, and 15% of the nation's.

Gas Age goes on to say that new home construction will account for 60% of these customers. However, in some areas—New England is one—reconversions will exceed new construction as a customer-source.

(*More Selling on page* 103)



For any telemetered variable . . .



Metropolitan Edison Company uses *ElectroniK* recorders to convert high-speed telemetered signals into strip-chart records of megavolts and megawatts, at the company's dispatching office in Reading, Pa. Metropolitan Edison has six generating stations and 205 sub-stations, serving a 14-county area in Pennsylvania. Combined effective capacity is 508,000 KW.

ElectroniK recorders at a load director's office in Reading, Pa., measure power generated by four power companies. Recorders show total system generation, interchange, frequency, of more than 20 generating stations, and tie-in interchange with neighboring companies in a four-state area. The *ElectroniK* recorders, accurate within ± .25 of 1%, provide a continuous check and record of operating trends, and permit more accurate estimate of future demand.

You can measure all your telemetered variables with *ElectroniK* recorders

ElectroniK
instruments can record . . .

- system load
- net interchange
- voltage
- frequency
- sky illumination
- time deviation
- total generation
- station generation
- tie-line loads
- outside air temperature
- outside humidity
- wind velocity
- wind direction

Many of the nation's leading power companies rely on *ElectroniK* recorders for accurate working data.

These instruments record and indicate all telemetered variables with speed, precision and sensitivity . . . give a clear, continuous picture of system operation.

Your nearby Honeywell sales engineer can help you profitably utilize *ElectroniK* recorders for any or all of your variables. Call him today. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

Honeywell

H HONEYWELL

First in Controls

From one source . . . instrumentation for every need

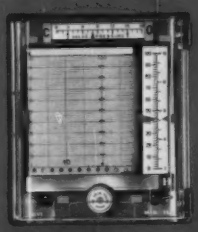
Honeywell offers a line of instruments no other manufacturer can match for completeness. You can save money in purchasing, installation and maintenance by buying all your instruments from this one dependable source.

Multi-point circular scale indicator

Vertical scale indicator

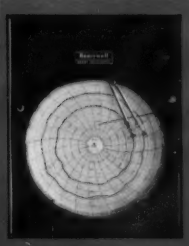
Circular chart *ElectroniK*

Circular scale *ElectroniK* controller



Tel-O-Set miniature recorder

Differential Converter liquid level transmitter



Two pen recording thermometer and pressure gage

Flow recorder with electronic integration

Pressuretrol non-indicating pressure controller

Spring-loaded thermocouples

Thermocouple wire for permanent installation

Series 800 diaphragm control valve

These are but a few of the products in the Honeywell line. The complete line covers electric, pneumatic, electronic and mechanical types of indicating, non-indicating, transmitting, recording and controlling instruments—including miniature models . . . plus a comprehensive selection of valves, primary elements and accessories.

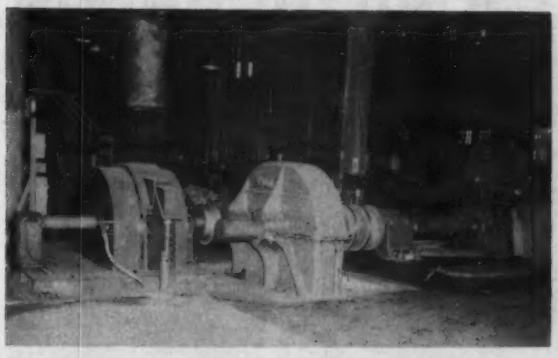
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell

H HONEYWELL

First in Controls

PRINTED IN U.S.A. D91-4 36M June, 1957



400-hp motor on roughing mill . . .

. . . 600-hp units for finishing . . .

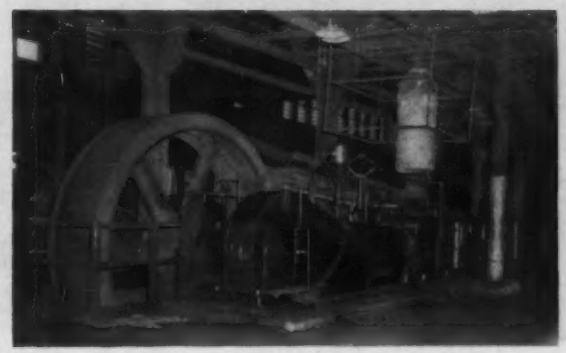
Raise Output, Improve Mill Operation . . .

. . . as steam yields to purchased power.

HARRY F. MOORE, Power Sales Engineer, Pennsylvania Power & Light Co, Williamsport, Pa.

Production has gone up, equipment runs better, and there is less noise and vibration at the Jersey Shore Steel Co, South Avis, Pa., since the company switched to purchased electric power and shut down a 750-hp steam engine. Mills used to produce steel angles and bars from old railroad rails now have full power, run at constant speed, even when full of steel. And the actual operating costs are below the estimated figure, although Jersey Shore is now handling larger rails than ever.

With a load of approximately 905 kw, the company is served at 66 kv. A 2,250-kva substation, comprising one, 750-kva, 66-kv/440-v transformer and one, 500-kva 66-kv/2,300-v transformer was designed for the company by Pennsylvania Power & Light Co. Primary distribution inside the plant is at 480 v and 2,300-v. The major part of Jersey's load is in a 400-hp roughing mill and an 800-hp finishing mills which operate from the 2,300-v line. Previously, all were driven by the steam engine.



Prior to the installation, some d-c power was purchased from an adjacent railroad installation. Metering was installed on these lines to determine the company's actual power requirements. The utility also helped Jersey Shore decide on the proper delivery voltages after motor starting requirements were determined.

Cable Keeps Ram Running

GLEN J. ALDEN, Industrial Sales Engineer, Minnesota Power & Light Co, Duluth

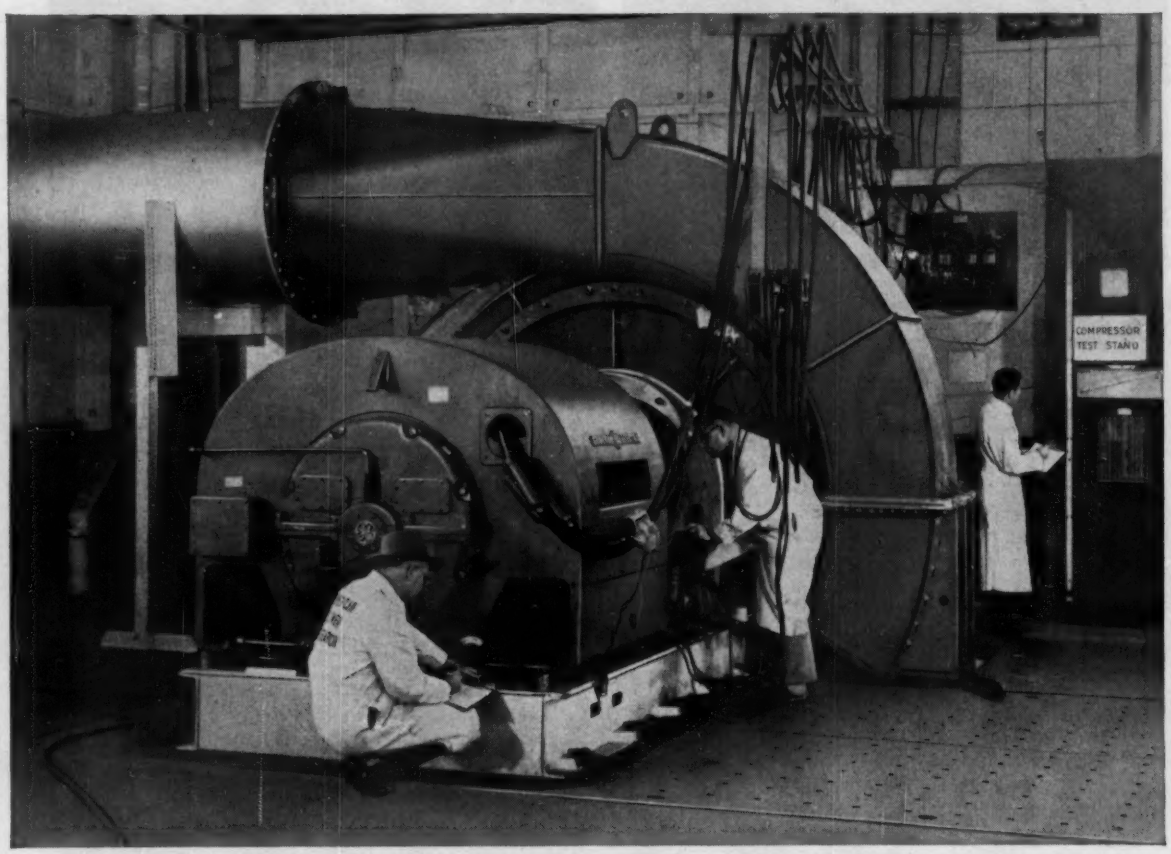
Electric heating cable wrapped around the lines and valves of a hydraulic ram at the Union Compressed Steel Co, Duluth, Minn., assures continued operation of a metal scrap baler despite severe winter weather. The company is no longer plagued by freeze-ups or congealed oil. The 5-kw installation maintains an oil temperature of approximately 50 F, preventing production shutdowns. Before the cable was installed, extremely cold weather often froze the condensed moisture or congealed the oil to the point where operations had to be suspended.

High Light for Industry

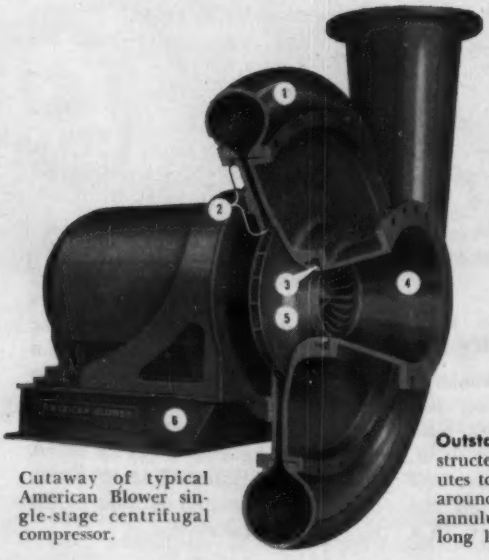
A 1,000-foot candle industrial lighting system is now under test at the General Electric Co's Nela Park Lighting Institute at Cleveland, Ohio. Comprising 27 fluorescent fixtures mounted ten feet off the floor, the installation covers a 15 x 24-ft ceiling area in a workshop. Operating at 400 cycles per second rather than conventional 60 cycles, it reduces ballast weight by approximately 20 lb per fixture. By comparison, industrial lighting levels of 100 to 200 foot-candles are well above average. One of the highest levels in use heretofore is a 400-foot candle installation on an aircraft assembly line.

Cost of energy to operate the new lighting is about 15 cents an hr. A new type of grooved lamp which doubles light output is used in the high level installation.

Here's the latest air-handling



LABORATORY TESTED CENTRIFUGAL COMPRESSOR DELIVERS 330,805 POUNDS OF AIR PER HOUR!



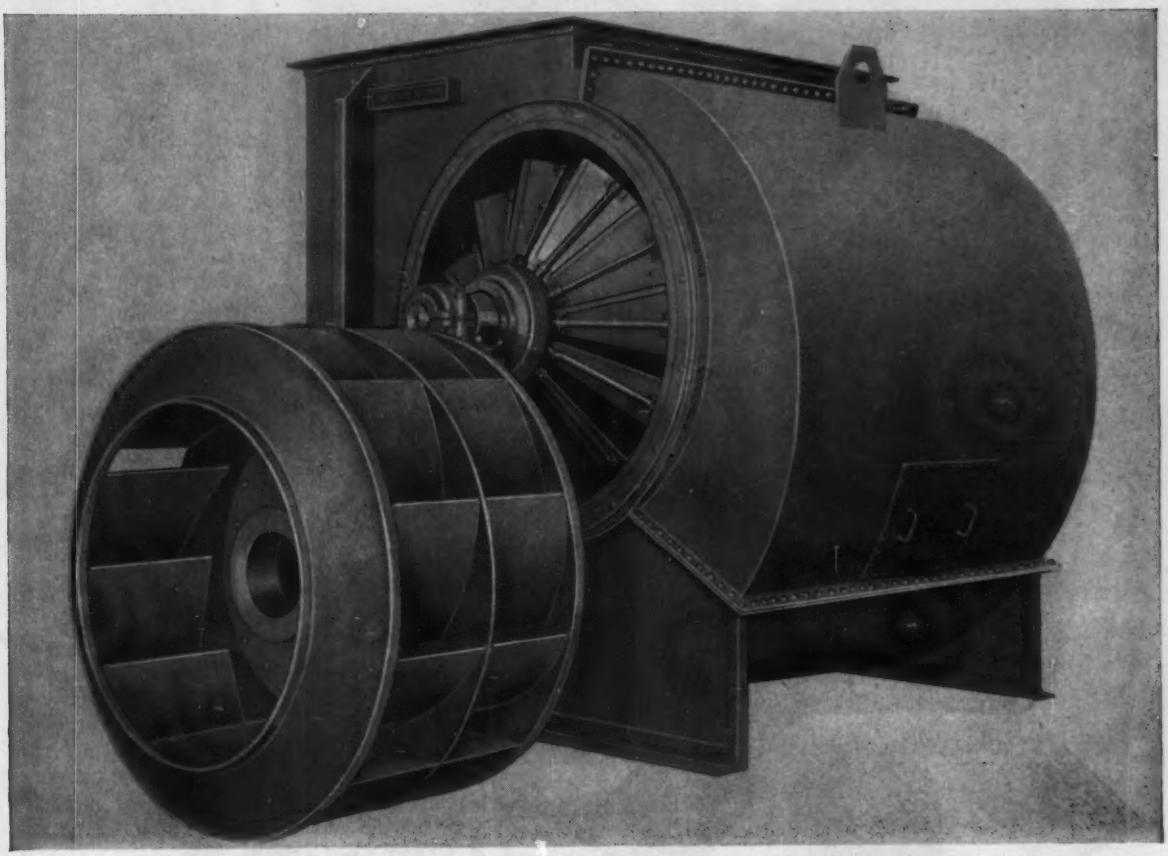
Cutaway of typical American Blower single-stage centrifugal compressor.

With the trend toward higher pressure requirements, American Blower has designed and built centrifugal compressors to furnish air for cyclone fired boilers. These compressors incorporate the use of a horizontally split, welded steel volute casing, variable inlet guide vanes, welded steel impeller of the shrouded type with impeller shaft supported by two journal bearings plus a Kingsbury thrust bearing arranged for positive forced-feed lubrication. This highly efficient compressor is driven by a 1000 HP, 1800 rpm, induction motor, delivers 330,805 pounds of air per hour at a static discharge pressure of 67.5 inches water gauge.

Like every American Blower single-stage centrifugal compressor—30 to 2250 HP—this compressor has been completely tested in accordance with the A.S.M.E. Power Test Code. Such testing guarantees the mechanical operation and performance of all American Blower compressors.

Outstanding features: (1) Improved scroll-shaped casing design. (2) Unobstructed long diffuser passage converts velocity energy into pressure, contributes to quiet operation. (3) Annulus packing minimizes recirculation of gas around impeller inlet. (4) Removable inlet nozzle for accurate alignment of annulus packing. (5) Aero-dynamic design of impeller blades for high efficiency, long life. (6) Welded-steel baseplate "stress relieved" prior to machining.

equipment from American Blower

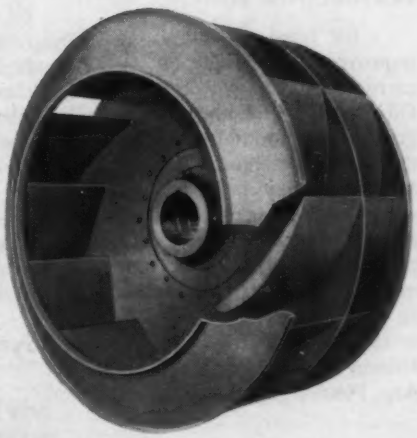


AIRFOIL FAN HAS ADVANCED DESIGN FOR HIGH EFFICIENCY, LOW OPERATING COST

Featuring a functionally designed airfoil blade, American Blower's improved Airfoil Fan is the industry's best in the non-overloading-horsepower type of centrifugal fan.

That's because smooth interworking of improved streamline inlets, wheel rims, and housing minimizes turbulence, resulting in higher efficiency, lower power consumption. The non-overloading-horsepower characteristic makes it possible to select a driving motor close to the fan horsepower.

Why not talk to an American Blower sales engineer about *your* requirements. His knowledge of air-handling applications can prove invaluable to you. Call our nearest branch office, or write: American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products.



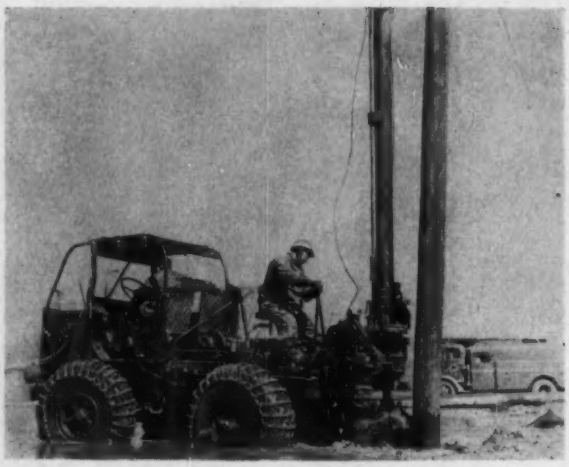
Special design of the airfoil blade and matching streamline inlet are the top features of American Blower Airfoil Fan. The dieformed, reinforced, and welded blades are extra strong, extremely efficient. Single- and double-inlet Airfoil Fans are available in many sizes, and for volumes up to 1,000,000 cfm.

AMERICAN BLOWER

Division of AMERICAN-Standard

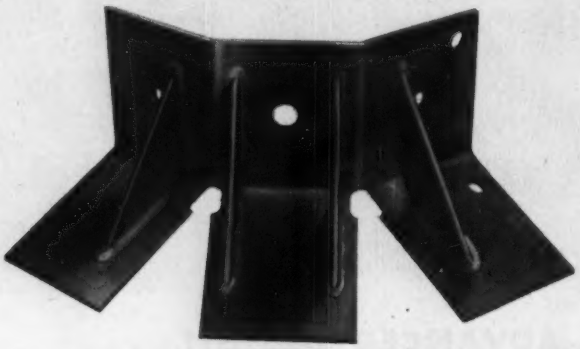
NEW EQUIPMENT

Digger Carrier . . .



. . . is rubber-tired earth boring and pole setting vehicle with four-wheel drive. Called the Blue Ox Utility (BXU) digger, it serves both for spot installation of poles and for new line construction. Vehicle travels paved or unpaved roads at speeds up to 55 mph without damage to roadbed. Under normal conditions, it operates on landscaped shoulders and in residential areas without tearing up terrain. High traction and maneuverability enable it to traverse soft grades and adverse country.

Vehicle has rear mounted digger and winch, can be fitted with additional front-mounted winch or with 33-ft, 360-deg aerial tower for off-the-road line maintenance or insulator washing.
Four Wheel Drive Auto Co, Clintonville, Wis.



Pole Bearing Plates . . .

. . . prevent uplift forces from pulling single pole out of ground or upsetting balance of poles on H-frames. Pair of plates on butt of pole provide collective 200 sq in. of cone-shaped bearing surface. Weight is 18 lb per unit. Made of quarter-inch mild steel, they are obtainable with asphalt paint or hot dip galvanized finish.
A. B. Chance Co, Centralia, Mo.

Washer Material . . .

. . . for breakers and disconnects improves conductivity in current-carrying hinged connections. Called Gibsiloy NC-205, the silver-nickel-graphite compound will not gall despite heavy sliding action. Contact rings may be furnished with silver solder backing. After brazing, they may be planished to improve assembly, hardness, and flatness. Rings have long life and can be used as loose washers or brazed to copper blades.
Gibson Electric Co, 8351 Franklin Ave, Pittsburgh 21, Pa.

Silicon Rectifiers . . .

. . . for electrostatic precipitators add an estimated 10 years to rectifier life and are economical to operate and maintain. Immersed in oil or askeral along with the transformer, these hermetic units have high conductance and power handling ability. Efficiency is 96%. They allow higher circuit efficiency and temperature stability and have no voltage drop due to aging. They are available, for new installations, rated 500 ma and 70 kv, peak.
Research-Cottrell, Inc, Bound Brook, N. J.

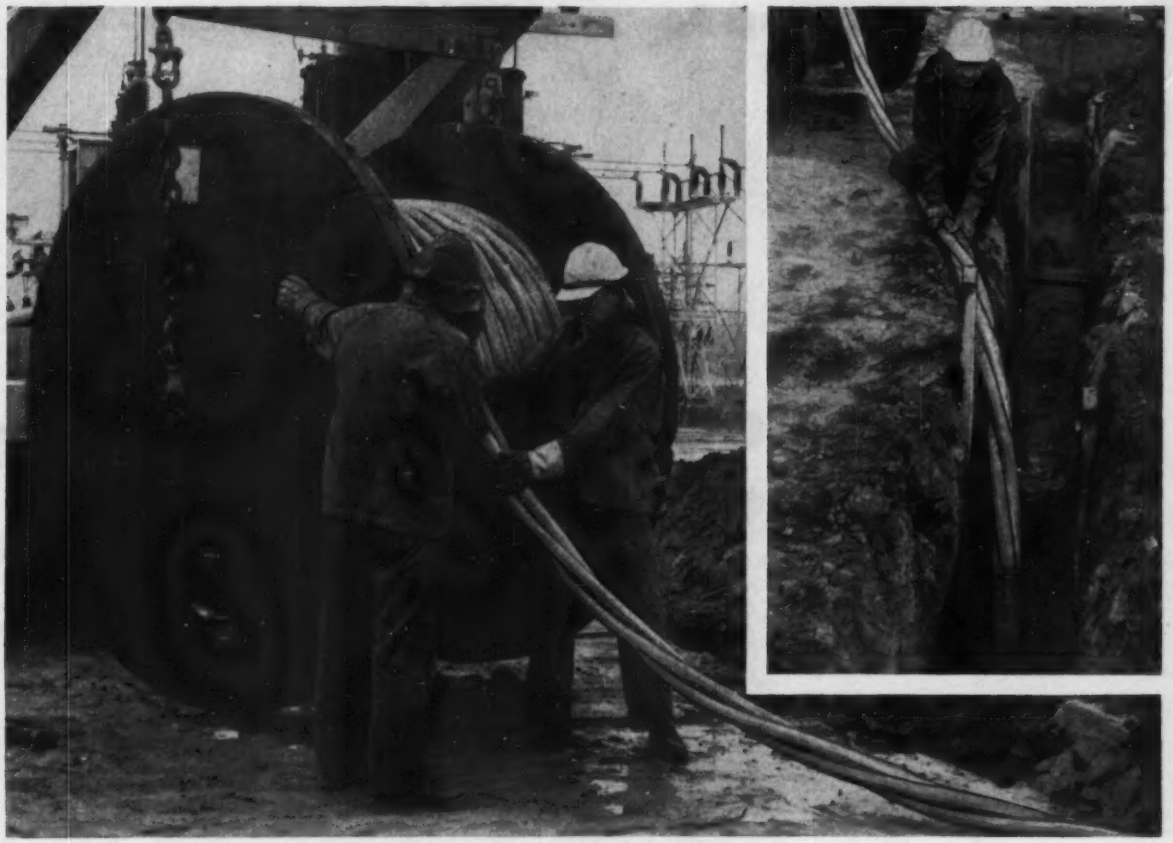
Synchronizer . . .

. . . automatically matches generator speed to that of system. It supplies control pulses to speed control motor of generator and provides closing pulse for the generator circuit breaker. To limit paralleling shock, action is delayed until frequency difference is 0.5 cycles or less. Closing impulse has lead time to assure proper timing of breaker action. Paralleling occurs without necessity of actually holding synchronism. Unit may remain set up for hours without risk.
Brown Boveri Corp, 19 Rector St, New York 6, N. Y.

Lay-in Duct Hanger . . .

. . . is strong and speeds up duct hanging. With this two-piece hanger design, duct can be installed more than twenty different ways. Complete line includes fittings, lengths, connectors, tees, ells, junctions, and telescopes. Joint design insures maximum rigidity in duct run.
Square D Co, 6060 Rivard St, Detroit 11, Mich.

(*More New Equipment on page* 110)



BURIED TO SAVE COSTS

Neoprene protects Baltimore Gas and Electric cables from electrolytic and chemical corrosion

Baltimore Gas and Electric Co. recently installed two 35-Kv triplex cables between a Master Substation and an industrial company's switching station nearby. The paper-insulated cables are sheathed with copper-bearing lead. Neoprene protective jackets are bonded to the sheaths. Cables are buried directly in the earth at a depth of 33" and surrounded by a sand bedding. A 2" concrete slab protects them from mechanical damage.

By burying the cables, the company was able to cut construction costs materially. The neoprene jacketing provides needed corrosion protection because it prevents deterioration of the lead sheath due to galvanic cell action and chemical corrosion.

Baltimore Gas and Electric has also installed neoprene-over-lead cables at other substations and a large shopping center, which is supplied with power from a 4000' underground loop surrounding the whole area.

Installations like these offer added proof of neoprene's acceptance for wire and cable jacketing. Of all resilient materials, only neoprene has balanced resistance to sunlight and weathering, oils and chemicals, heat, flex cracking, abrasion and cutting, oxidation and aging.

Ask your supplier about wire and cable jacketed with neoprene. It's available in single and multiple conductor types and voltage ratings to meet your requirements. Mail the coupon below to get the ELASTOMERS NOTEBOOK with actual on-the-job reports of neoprene's performance in a wide range of industrial products.

DU PONT

Better things for better living
. . . *through chemistry*

NEOPRENE
— made by Du Pont
for 25 years

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. EW-7
Wilmington 98, Delaware

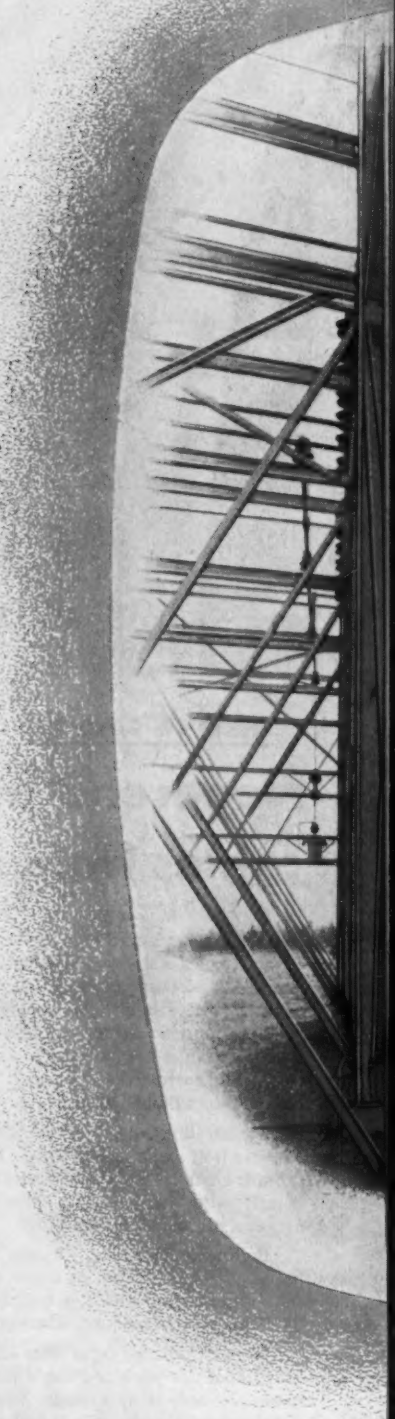
Please put my name on the mailing list for the Elastomers Notebook.

Name_____
Position_____
Firm_____
Address_____
City, State_____

MAIL THIS COUPON NOW . . . WHILE YOU'RE THINKING ABOUT IT

An example of Allis-Chalmers

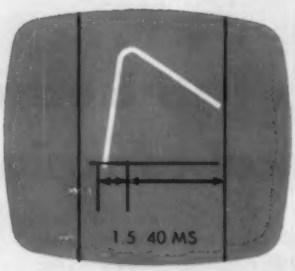
world's first 600,000-kva transformer bank



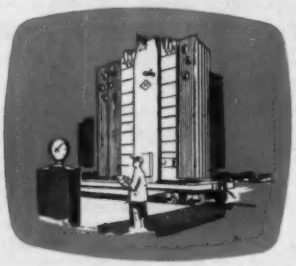
These three 200,000-kva, single-phase power transformers are now in service. Three duplicates are operating on the other end of a 345-kv transmission line.

Features of these transformers include:

- Corona-free design — prevents insulation damage due to corona. Testing included new switching surge test at 930,000 volts.
- Bank is rated 360,000 kva self-cooled, 480,000 kva with first set of fans, and 600,000 kva with a second set of fans.
- Lighter weight — Heavy plate aluminum in core and coil construction cuts shipping weight.



Tested for freedom from corona and switching surge capability



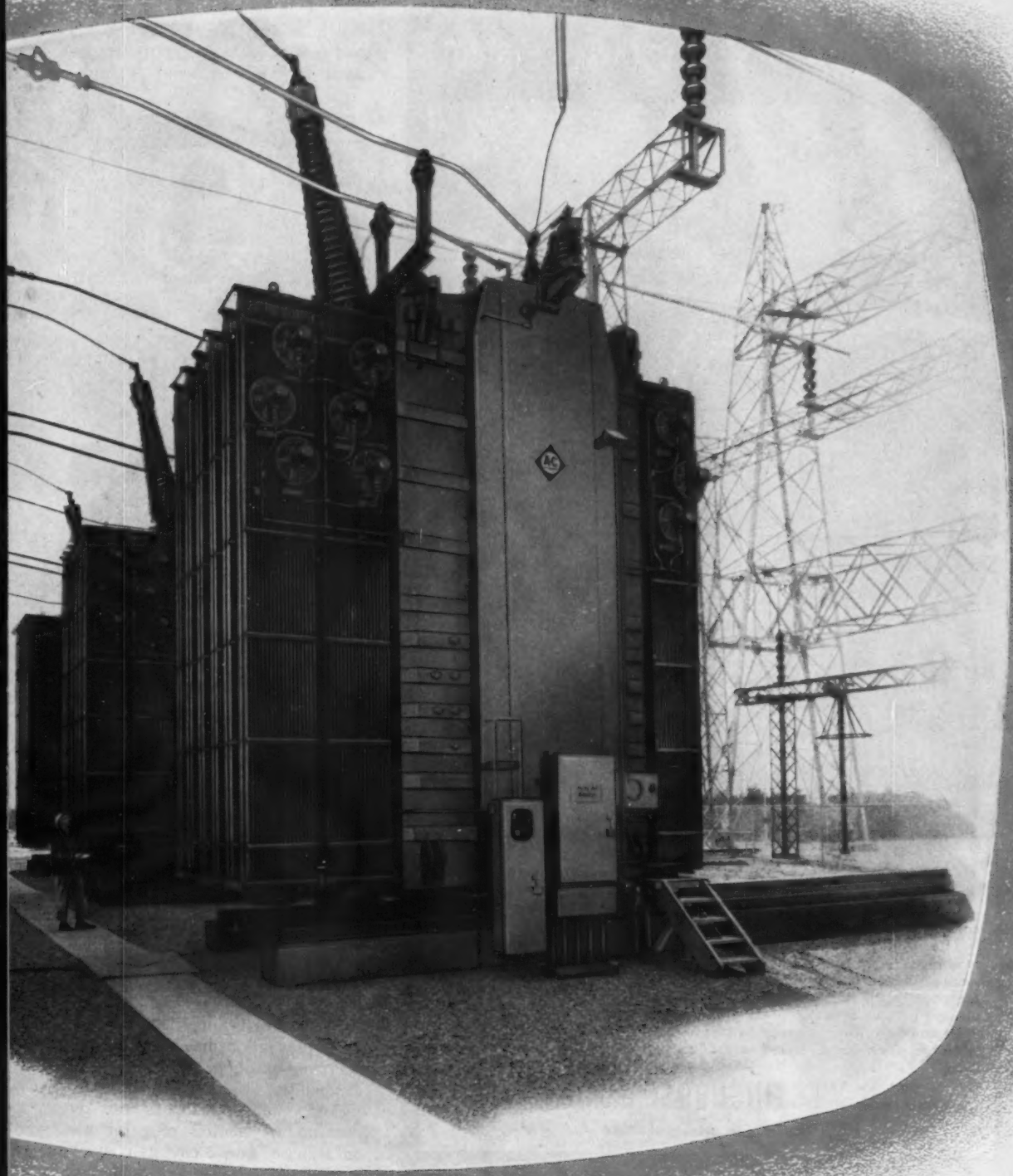
Use of aluminum cuts shipping weight

These units are examples of Allis-Chalmers leadership in helping power systems meet increased demands for power.

For information regarding latest transformer developments, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

leadership in transformers

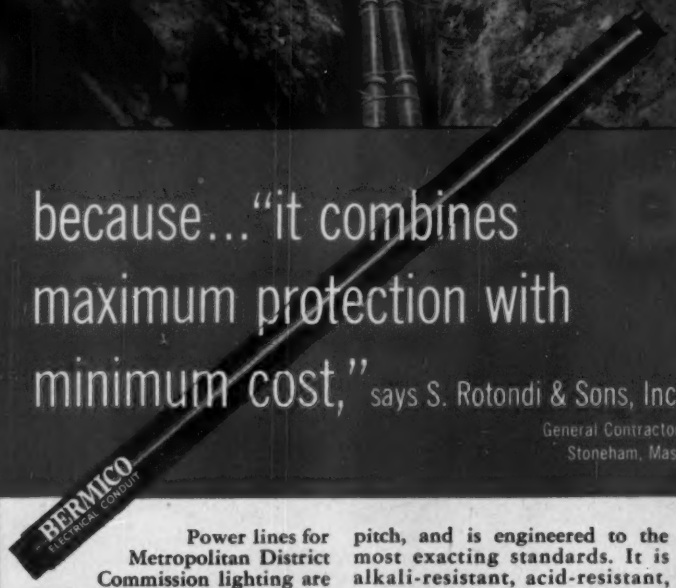


A-C
ALLIS-CHALMERS

A-5407

BERMICO® electrical conduit used in new Boston parkway system

because..."it combines maximum protection with minimum cost," says S. Rotondi & Sons, Inc., General Contractors, Stoneham, Mass.



Power lines for Metropolitan District Commission lighting are encased in Bermico Conduit.

The installation, shown above, is along Route 28, Medford, Massachusetts, and is part of the new metropolitan parkway system around greater Boston.

Bermico Conduit is made from cellulose fibre impregnated with pitch, and is engineered to the most exacting standards. It is alkali-resistant, acid-resistant, light, strong, uniform, and is installed quickly and easily. Bermico Conduit is specified by public utilities and by consulting engineers from coast to coast. For speedier cable installation specify Bermico Conduit. Immediate shipment of all sizes and fittings guaranteed.

Distributed by WESTINGHOUSE Electric Supply Company

Offices in principal cities

BROWN COMPANY

BERLIN, N. H.

General Sales Office: 150 Causeway Street, Boston 14, Mass.

Outdoor Switchboards . . .

. . . **are metal-enclosed, with sheltered space for servicing personnel.** They eliminate need to allot control building space to switchboards and can be located near the equipment they protect, with a consequent reduction in wiring. When several units are installed side by side, side sheets are eliminated and sheltered space becomes a walk-through aisle. Enclosures have internal illumination, heaters, outlets, and ventilation.

General Electric Co, Schenectady 5, N. Y.

Bus Duct Disconnect . . .

. . . **handles all ratings from 15 amp, 250 v to 100 amp, 600 v.** Designed to simplify inventory and installation problems, the plug-in units use the same E and F frame molded case StaBreakers as the manufacturers line of AB-Is and distribution panelboards.

Enclosure has interlocking handle to prevent opening when breaker is in "on" position. Positive handle mechanism, which may be padlocked, plainly indicates breaker position. A neutral plug for use on 3-phase, 4-wire circuits is available as an accessory. Solderless connectors are used.

Federal Pacific Electric Co, 50 Paris St, Newark, N. J.

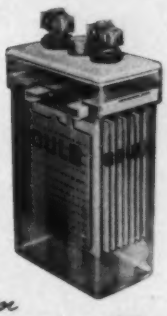
(*More New Equipment on page* 114)

Gould Teamwork Scores for Battery Users:

Making sure that you get maximum service from your batteries is the full time job of Gould field engineers. They help set up your battery maintenance shop, help establish good preventive maintenance procedures, make routine calls to check up on conditions and instruct your new personnel in correct maintenance procedures. This teamwork costs you nothing . . . as a matter of fact, it can't help but *save* you money. Why not take advantage of it? See your local Gould representative; or write Gould-National Batteries, Inc., Trenton 7, N. J.

Always use Gould-National Automobile and Truck Batteries

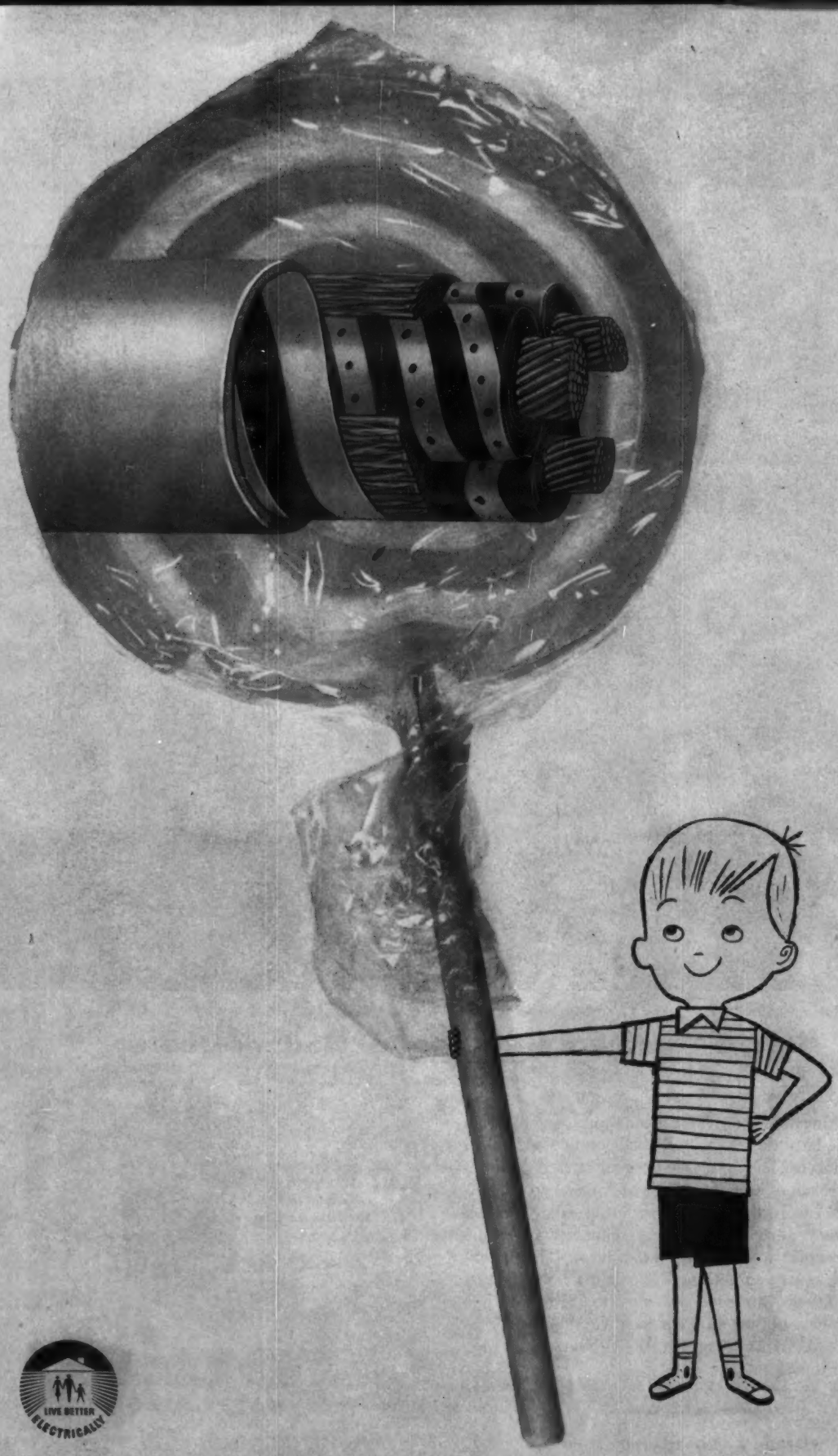
©1957 Gould-National Batteries, Inc.



America's Finest!
GOULD PLANTÉ
The Aristocrat of
Stationary Batteries

More Power to you from

gould
BATTERIES


LIVE BETTER
ELECTRICALLY

lasts and lasts and lasts...

TELLURIUM LEAD ALLOY SHEATH ADDS YEARS OF LIFE TO ROEBLING PAPER POWER CABLE

Roebling Tellurium Lead Alloy Sheath was developed *specifically* to meet the greater stress requirements of today's high loadings and increased operating temperatures.

And it does just that, with its—

4½ Times Greater Bending Fatigue Resistance over ordinary sheath, even in small bending radii.

Remarkable Creep Resistance—actually creeps 90% *less* than ordinary sheathing!

Outstanding Heat Stability—no change in structure or properties after treatment at 400° F.

Negligible Age Hardening—stays "young," ductile, for years.

Resistance to Vibration Fatigue—withstands punishing road vibrations.

Combine these features with superior quality *Roebling Paper Power Cable*, and you can see why more and more companies look to Roebling for cable that lasts . . . and lasts!

Interesting technical data regarding the special properties of cost-saving Roebling Paper Power Cable with Tellurium Lead Alloy Sheath are available from Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, N. J.

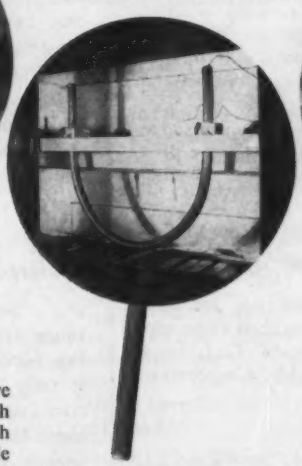
ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

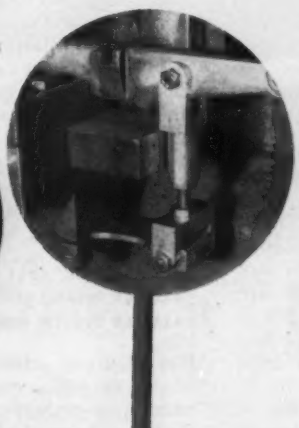
Roebling Paper Power Cable with Tellurium Lead Alloy Sheath is available with either copper or aluminum conductors.

Accelerated life tests prove Tellurium Lead Alloy Sheath far exceeds ordinary sheath in standing everyday cable stresses.

INTENSIVE TESTS PROVE UNUSUAL SERVICE QUALITIES



Tellurium Lead Alloy Sheath takes 4¾ times more bending than copper lead alloy sheath under identical test.



Roebling Tellurium Lead Alloy Sheath shows its long-term resistance to effects of road vibration in a high-frequency test machine.

Roebling Tellurium Lead Alloy Sheath has 90% less creep than ordinary sheath as proved over extended periods in test ovens.

Each of the two illustrated troughs can carry as much cable as all of the paralleling conduit

COPE CABLE TROUGH SAVES STEEL BY THE TON!

Problem. 100 miles of cable to be supported in a New Jersey power generating station.

Solution. A careful cost analysis of available methods and materials convinced plant engineers that Cope's expanded-metal cable trough was the best choice. Why? Among other reasons, it meant a saving of more than a ton of steel for every 60 feet of trough installed, as compared to conduit . . . a total saving in excess of 250 tons of steel for the 15,000 ft. of trough required for the completed job!

Here's How You Save. *One* 10 foot section of 24" width Cope trough supports as many cables as 16 lengths of 4" conduit and it only weighs 54 lbs., compared to 575 lbs. for this same amount of conduit. This adds up to real economy regardless of the size of your installation. Cope's expanded-metal cable trough simply uses *less* steel to do the job and obviously this can mean substantial savings for you!

Cuts Labor and Maintenance Costs, Too. Design and construction features of lightweight Cope trough speed installation of space saving systems—even in the most cramped quarters. Easy-to-get-at trough simplifies cable inspection and repair . . . provides ready re-routing and facilitates system additions.

You save *three* ways when you specify Cope cable supporting equipment . . . trough, ladder or channel.

- **LOWER FIRST COST**
- **LOWER INSTALLATION COSTS**
- **LOWER SYSTEM MAINTENANCE COSTS**

Discuss these advantages for *your* installation with a qualified Cope representative—or write to T. J. Cope Division, Rome Cable Corporation, Collegeville, Pa.

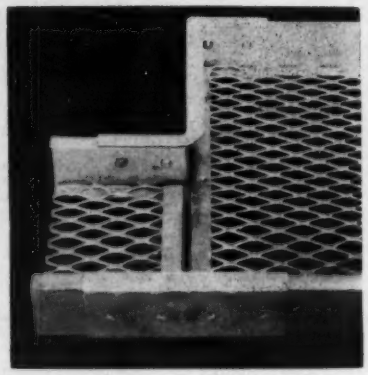
1000

T. J. COPE *Division*

ROME CABLE CORPORATION

Distribution Center . . .

. . . **for inplant use combines incoming line, transformer, and outgoing feeder** in one piece. Operation and routine servicing can be done from the front. No vault is required. Using a dry-type transformer, the unit is rated 112.5 kva, 3-phase, 4160 to 208y/120 v. High voltage section has three 3-kv lightning arresters and gang operated, oil fused cutouts. Low voltage section has 3-pole, thermal magnetic, molded case circuit breakers. Similar designs with various combinations of high and low voltage in all kva and voltage ratings are available. **Standard Transformer Co, Warren, Ohio**



Trough Fitting . . .

. . . **is a combination reducer and connector.** Used either right hand or left hand, it replaces one reducer and two connector sets in joining long length sections and fittings such as elbows, tees, risers, and crosses. Fittings are sized for 3-, 6-, 9-, 12-, or 18-inch reduction.
P-W Industries, Inc, Duncan & Melrose St, Philadelphia, Pa.

Multiple Point Recorder . . .

. . . **features replaceable plug-in range clips for quick range changing.** Model 6705 strip chart recorder is only 17.15-inches wide and records up to 24 points on one instrument. Both chart speeds and printing speeds are easily changed. Instrument operates on null balance principle. Alarm switches may be added.

(*Continued on page* 116)

A RESPONSIVE CONTROL THAT PERMITS FASTER OPERATION...

AS WELL AS increases operational efficiency, lowers maintenance cost and reduces first cost

The Paceco Dual Torque Crane operates at high speed with light load and low speed with heavy load – with many speed steps in between. This flexible operation is performed by *one* hook, *one* trolley hoist and *one* set of electrical controls utilizing a magnetic amplifier in conjunction with a weakening of the field in the hoist motor. Accurate speed control is entirely independent of loads.

The simplicity of the Paceco Dual Torque design reduces first cost and lessens maintenance. The variable hoist speeds save time in placing hook for lifting, speeding hook movements as much as 5 to 1.

By using a single hook and a single trolley hoist in place of a double hoist trolley, operators benefit by better hook approaches to the runway rails and an expanded working area under the crane.

The Paceco Dual Torque mechanism may be used on both gantry and bridge cranes.

Besides cranes, Paceco designs and fabricates all types of major mechanical equipment. May we send you our illustrated brochure on such products?

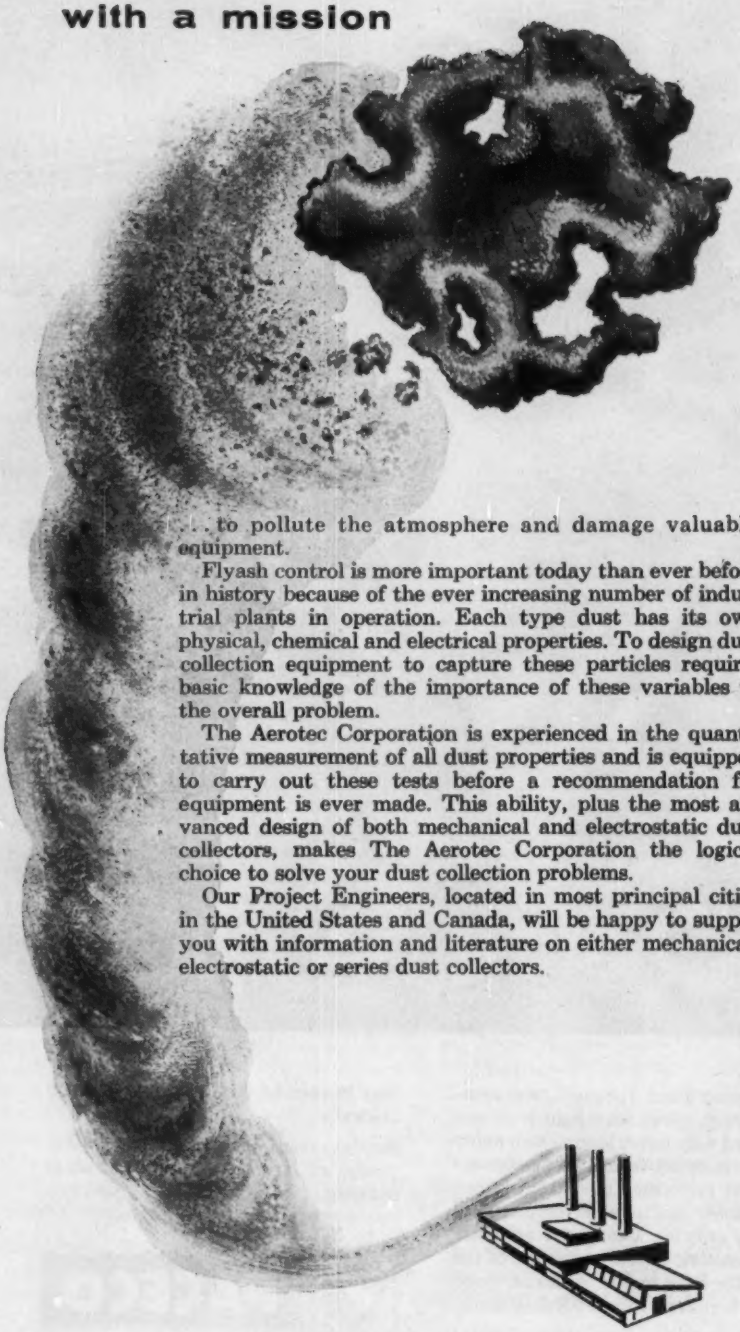
PACECO
"TAILORS OF STEEL"®

PACIFIC COAST ENGINEERING COMPANY
ENGINEERS • MACHINISTS • FABRICATORS
Alameda, California, LAkehurst 2-6100
PACIFIC COAST ENGINEERING CO., INC.
New York 17, 51 East 42nd Street, OXford 7-1475
REPRESENTATIVES
Pasadena 8, Calif., 774 E. Green St., RYan 1-9373
Kansas City 12, Mo., 4706 Holly Street, PLaza 3-3737
Houston 1, Texas, P. O. Box 1035, MOhawk 3504

†PATENT APPLIED FOR

Dust Particle

with a mission



. . . to pollute the atmosphere and damage valuable equipment.

Flyash control is more important today than ever before in history because of the ever increasing number of industrial plants in operation. Each type dust has its own physical, chemical and electrical properties. To design dust collection equipment to capture these particles requires basic knowledge of the importance of these variables to the overall problem.

The Aerotec Corporation is experienced in the quantitative measurement of all dust properties and is equipped to carry out these tests before a recommendation for equipment is ever made. This ability, plus the most advanced design of both mechanical and electrostatic dust collectors, makes The Aerotec Corporation the logical choice to solve your dust collection problems.

Our Project Engineers, located in most principal cities in the United States and Canada, will be happy to supply you with information and literature on either mechanical, electrostatic or series dust collectors.

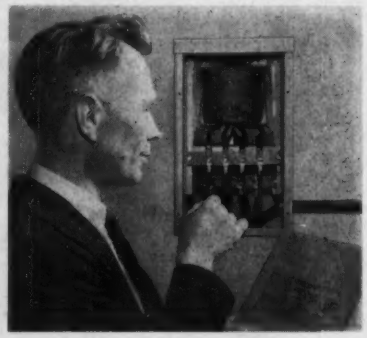
Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.
(Offices in 38 principal cities)
Canadian Affiliates: T. C. CHOWN, LTD., 164 Metcalfe Ave., Westmount, Montreal 6, Que.
Manufacturers
THE AEROTEC CORPORATION
Greenwich, Conn.

Multiple Point Recorder

(*Continued from page* 114)

Numbered dot printing and internal fluorescent lighting are also obtainable.

Weston Electrical Instrument Corp, Newark 12, N. J.



Dry-Type Transformers . . .

. . . **with Class H insulation are intended for lighting** applications on circuits up to 600 v. Rated 3, 5, 7.5, and 10 kva, they have high temperature resistance, moisture resistance, and chemical stability. Removable front panel makes clamp-type terminals readily accessible.

Coil and core are elastically suspended for quiet operation. Core is grain-oriented steel. Transformers have low exciting current. Operating temperature at the terminal boards is low enough for normal cable entrance.

R. E. Uptegraff Mfg Co, Scottdale, Pa.

MORE NEW PRODUCTS

Self-contained **portable millivoltmeter recorder** has sensitivity of 2,000 or 10,000 ohms per v, is used for corrosion surveys and measuring millivolt drop on underground cables of known resistance. It records on 8-inch diam. chart—Bristol Co, Waterbury 20, Conn.

Cable insulating tape of laminated Mylar and aluminum foil is light weight, helps run off ionizations currents, and works at 275 F. Widths are 0.75, 0.875, and one inch—Dobeckmun Co, Box 6417, Cleveland 1, Ohio.

NOW: From General Electric's
Regulator Engineers:
A Chart Designed To Help You . . .

COMPARE REGULATORS

Single-phase Step Voltage REGULATOR FEATURE	G-E	A	B	C	MEANING OF FEATURE
Electrostatic Shielding	YES	NO	NO	NO	Helps prevent build-up of arc-causing carbon deposits at critical points.
Controlled Switch Speed	YES	NO	YES	YES	Gives longer contact life. Means less maintenance.
32 ⅛% Step Regulation	YES	YES	YES	NO	Provides closest voltage control. Less contact wear.
Locking Screws On All Control Knobs	YES	NO	NO	NO	Makes sure that settings stay set.
Panel-mounted Reverse-Reactance Switch	YES	YES	NO	YES	Simplifies parallel or delta-connected applications.
Plug Connections On All Major Control Components	YES	NO	NO	NO	Allows easier, quicker maintenance of control.
Complete Range of Ratings	YES	YES	NO	YES	Facilitates your system planning.
One-piece Cover Bands	YES	NO	NO	NO	Simplifies maintenance. Pleasing appearance.
Aluminum/Copper Terminals	YES	NO	NO	NO	Offers flexibility; either type of conductor can be connected.
Lightning Arrester For Control Circuit	YES	YES	YES	NO	Provides additional protection to vital regulator controls.
Internal Thyrite* By-Pass Resistor	YES	NO	NO	NO	Affords maximum protection with no chance of external damage.
Steel Control Panel	YES	NO	YES	NO	Provides rigidity. Panel will not warp or break.

FOR MORE INFORMATION on the benefits your system can get with General Electric feeder voltage regulators, contact your G-E Sales Representative or write Section 423-19, General Electric Co., Schenectady 5, N. Y.

*Registered Trademark of General Electric Company for Resistance Material.

Progress Is Our Most Important Product

GENERAL ELECTRIC

6 WAYS TO PROTECT OVERHEAD TRANSMISSION DISTRIBUTION LINES WITH FANNGRIPS

ARMOR RODS

To protect and strengthen lines at points of maximum stress or where wear or breakage is likely to occur.

LINEGUARDS

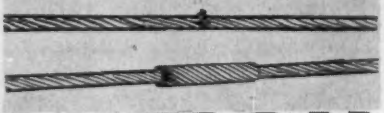
Economical conductor protection where short conductor spans and low tensions are used.

TAP ARMOR

Provides maximum line protection on long spans at the points of clamp attachment.

PATCH RODS

For open-span repairs, where conductor damage is minor and is confined to the wires of the outer layer.



PLASTIC FANNGUARDS

Protect wire coverings and prevent tree abrasion to overhead lines.

FANNGRIPS

Made of galvanized steel, aluminum alloy or copperweld. Powerful non-slip grip makes them ideal for conductor deadending, guying or for service drops.

FANNER Superformed PRODUCTS

Licensed for use under Patent No. 2,275,019

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THE FANNER MANUFACTURING COMPANY

Electrical Products Division

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Telephone: SHadyside 1-6000

AGENTS and DISTRIBUTORS IN PRINCIPAL CITIES

NOW . . . through its Plastic Division, **FANNER** offers a wide variety of **INSULATING TUBINGS** and **MOULDINGS** for electrical purposes.

CATALOGS–BULLETINS

• **GARDEN ILLUMINATION:** Bulletin 135-57 describing its aluminum twin receptacle "Pathlite" power unit adjunct to its garden lighting equipment line is available from Steber Mfg Co, Broadview, Ill.

• **MISCELLANEOUS:** The publications listed below were published recently by General Electric Co. The address is Schenectady 5, N. Y., unless otherwise indicated:

"Industrial Tachometers", GEC-1258A, is a 12-page bulletin on GE's line of generators and indicating or recording instruments for measuring speed of rotating equipment.

Tool for automation—Static switching systems are covered in Bulletin GEA-6364A which describes their operations, applications, and advantages.

Busway—A bulletin with information on its lighting-type busway for use as power supply to lighting fixtures and small power tools is available from Advertising and Sales Promotion, General Electric Co, Plainville, Conn. Write for Bulletin GEA-6170.

• **X-RAY UNIT:** Features of the Baltospot 200, a portable 200-kv x-ray unit for test applications, are shown in a release published by the Balteau Electric Corp, New and Meadow Streets, Stamford, Conn.

• **ELECTRICAL INSULATION:** Standard packaged INMANCO electrical insulation products for repair and maintenance of electrical equipment are in Catalog 21 of Insulation Manufacturers Corp, 565 West Washington Blvd, Chicago 6, Ill.

• **HEAT EXCHANGER:** A 16-page catalog describing its products in the field of heat transfer is published by Condenser Service & Engineering Co, 150 Observer Highway, Hoboken, N. J.

• **POSITIVE DISPLACEMENT PUMPS:** In a 32-page bulletin Milton Roy Co describes its line of motor-driven controlled volume pumps for metering and control of pH, Redox, conductivity, flow, etc. Write for Bulletin No. 553-1 to the company at 1300 E. Mermaid Lane, Philadelphia 18, Pa.

• **DISTRIBUTION TRANSFORMERS:** Materials and steps of production of distribution transformers for rural and industrial substations (75-500 kva, 67 kv and below, single phase) are shown in bulletin 61B6014C of Allis-Chalmers Mfg. Co. Milwaukee 1, Wis.

• **SILICONE-BASED GREASE:** Dow Corning Corp has released a brochure discussing its Dow Corning 41, a silicone-base grease, developed for high-temperature, slow-speed bearings. Write the company for No. 6-206 at Midland, Mich.

(*More Catalogs on page* 120)

ISOLATED PHASE BUS

Typical assembly with sliding section open. Two-way sliding section provides easy access to connectors—simplifies inspection and maintenance—effects savings in installation and operation.

SO MUCH MORE FOR THE SAME MONEY

All isolated phase bus meets industry standards; performs satisfactorily at rated current, voltage and temperature rise, with standard impulse levels; sells at competitive prices. But when selecting isolated phase bus for generator or any other applications, it is necessary to consider cost, *plus* installation and operating advantages. Here are some of the superior inherent advantages of I-T-E Isolated Phase Bus design that are not covered by industry specifications, yet effect substantial savings in installation and operation:

Most Simple and Efficient Design thermally, electrically and mechanically.

Fewest and Most Durable Gaskets, meaning direct savings in installation time and maintenance.

Greatest Installation Flexibility.

Tightest Bus ever designed. Dust and water leakage are eliminated.

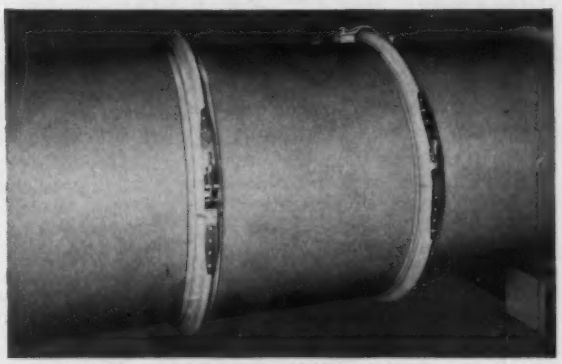
Lightweight. Save in installation time and labor. Also in building steel with supports and hardware.

Sliding Covers. Strategically located to insure stable mounting base for standard length and facilitate joint makeup and inspection when necessary.

Expert Engineering. Backed by more than 20 years' experience in the design and manufacture of isolated phase bus, insures quick, reliable engineering and excellent delivery.

Self-Cooled or Forced Air Cooled in ratings up to 14,000 amperes continuous.

Let us tell you more about I-T-E Isolated Phase Bus and its installation and operating advantages. Write for Bulletins 10004-A and 10004-B. I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Philadelphia 30, Pa.



Typical assembly with sliding section closed. Closure requires only two 1-piece round lifetime gaskets—easy to place and remove. Simple, powerful V-clamp couplings distribute clamping pressure uniformly around ring.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES LTD.

Continued from page 38

Another L&N solution to the area regulating problem

FP&L's H. W. Page and O. H. Bridges discuss new control center layout.

and, in 1951, Page predicted** a type of computer which closely matches the one now being built for his system. For example, he foresaw today's function generator which enables the computer to digest — and remember—the cost characteristics of each unit. The prediction went so far as to visualize the physical outline of some of the major computer-control components.

Building Block Approach

As a result, FP&L's planned approach to computer-control included installation of its present Area Control in 1955. It was a nicely planned move, for the control arrangement was well suited to future requirements—including the integration of an analog computer.

All Major Generating Sources Now Under Control

With its present Area Control, FP&L has all eight major plants—plus four ties with the Interconnected System — under automatic control. The control has sufficient flexibility not only to make lowest cost of generation possible, but also to permit automatic operation during the morning pick up as well as during periods of adverse conditions when it may be necessary to depart from economic loading to meet customer load demand.

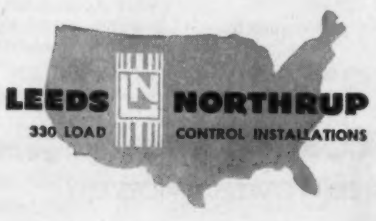
Adequate Feedback

A big reason for success of the control is the positive feedback of all significant control intelligence, including unit and station response to control signals. With regulating units moving in unison along their respective incremental cost curves, "hunting" among units and stations is eliminated—and with it, the unnecessary generation changes (including resultant dollar loss) which could occur if units were to respond to anything other than the basic (area) requirement.

The Operating Man: Guide to Lower Costs

In light of the work now in progress in Miami and other control centers around the country, we of Leeds & Northrup want to suggest that the operating engineers on your own system are your best guide to more economical, more reliable control. We find that when they review all the facts, they specify control by control specialists.

Let us send you the facts on some 40 typical Area Control installations as described by the utility company engineers who operate them. Just write to Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa.



***From a talk delivered to the Southeastern Electric Exchange, March 29, 1951. "Loading of Power Plants for Maximum System Economy."*

Catalogs–Bulletins

(*Continued from page 118*)

• **SUBSTATION STRUCTURES:** Bulletin 2006A released by R&IE Equipment Div of I-T-E Circuit Breaker Co, Greensburg, Pa., shows drawings, dimensions and catalog numbers for selection of its packaged substations.

• **AIR CONDITIONING:** Commercial package units are described in Bulletin 6125 of the American Blower Div of American-Standard, Detroit 32, Mich.

• **EXPLOSION HAZARDS:** A check list of 13 questions to help determine probabilities of electrically ignited explosions in plants is available from Hazard Finder, Dept HF, Crouse Hinds Co, Wolf & Seventh North Streets, Syracuse, N. Y.

TECHNICAL LITERATURE

CORROSION — "Underground Corrosion" by Melvin Romanoff covering the destruction caused to metallic structures buried in the ground or in contact with soil by corrosion has been recently published. Superceding NBS Circular 450 issued in 1945, this circular is a final report on studies conducted by the National Bureau of Standards over the past 45 years. Results of a field burial program studying electrical and electrochemical corrosion, including cathodic protection, along with field and laboratory investigations are reported in this 227-page publication. Ask for Circular 579 from the Superintendent of Documents, U. S. Government Printing Office, Washinton 25, D. C. Price is $3.00.

INDUCTION BRAZING—GE has published a reprint of "Induction Brazing: Advantages Justify Costs" by a member of its industrial heating department. Containing formulas for necessary power requirements and tables for computing coupling efficiencies for metals, the article points out the properties and advantages of induction brazing. Bulletin GER-1332 is available from General Electric Co, Schenectady 5, N. Y.

HEATING, VENTILATING, AND AIR CONDITIONING—An increased set of U-value tables and a new method for establishing standards for indicating heat stress are among the additions and revisions to the "Heating Ventilating and Air Conditioning Guide 1957" published by ASHAE. With essentially the same features of appearance, format, and arrangement this 35th edition contains 51 chapters grouped into the following seven sections: I—Fundamentals; II—Human Reactions; III—Heating and Cooling Loads; IV—Combustion and Consumption of Fuels; V—Systems and Equipment; VI—Special Systems; and VII—Instruments and Codes. Price is $12.00. Publication may be obtained from American Society of Heating and Air-Conditioning Engineers, 62 Worth Street, New York 13, N. Y.

BOOKS

So You Want To Be An Engineer

Building an Engineering Career, 3rd Edition. By Clement C. Williams and Erich A. Farber. Published by McGraw-Hill Book Co, Inc. 330 W 42nd St, New York 36, N. Y. 299 pages, illustrated. Price $4.75.

"Well begun is half done" goes the old saw. This book will help the engineering student to get off to a good start and to work efficiently from the beginning of his career in engineering. It aims at both orientation and motivation and has these objectives, among others:

1. To preview the character of the engineering profession.
2. To help the student acquire efficient study methods.
3. To reveal the creative nature of an engineer's way of thinking.
4. To introduce the student to the engineering vocabulary.
5. To inspire a will to achieve in study and in the profession.

An extensive outline of professional occupations has been included which should broaden the student's vocational outlook. Rare too in a book of this character is some astute guidance in the salaries. These pages cover such things as: factors that affect salaries, beginning salaries, earnings of all engineers as well as specific earnings of civil, mechanical, electrical, and chemical engineers.

This second revision includes the results of surveys since World War II—notably the section of salaries. In this edition they have also added hitherto unavailable material, including a chapter on atomic, nuclear, and solar energy.

Functional Lighting

Illuminating Engineering Course. By H. Zijl. Published by Phillips Technical Library and distributed by Cleaver Hume Press Ltd., 31 Wright's Lane, Kensington, London, England. 243 pages, illustrated. Price $4.50.

The contents of this book are confined mainly to functional lighting. The author gives some principles that readers with only a limited technical background can assimilate and use to solve specific lighting problems.

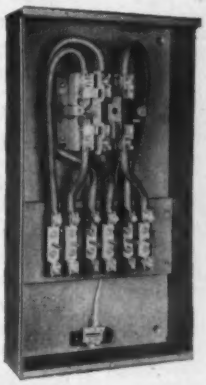
The first part of the book deals with the theory and measurement of light. The latter parts discuss lighting system requirements and types of lamps. The author has wisely recognized the important part that sensory perception, a nontechnical aspect, plays in the evaluation and planning of lighting systems.

This broadens the outlook of the book and should make the text valuable not only to lighting engineers but also to those who have a scientific curiosity about illumination.

ANCHOR

SAFETY SOCKET METER CABINETS

Combination devices with compartments for test switches or test blocks below the socket, which offer simple means of disconnecting, by-passing and field testing of meters. Test device space can also be used as a pull box for underground services.



Cat. No. 2007-WM
both covers removed, 7 terminal 200 amp. socket wired with 4/0 to 6 pole 200 amp. test block.

For 100 ampere and 200 ampere services and for 4, 5, 6, 7, 8, 13, 14, & 15 terminal meters.

•

With or without test devices and wired or unwired.

•

Steel or Aluminum.

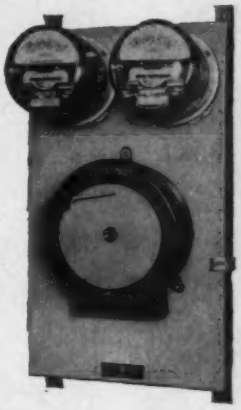
•

Indoor or Outdoor.

•

Flush or Surface.

•



Cat. No. M-213
with two 13 terminal meters with contact operated demand meter mounted on hinged door.

Separate sealable and removable covers over test block chambers. May be hinged for indoor use.

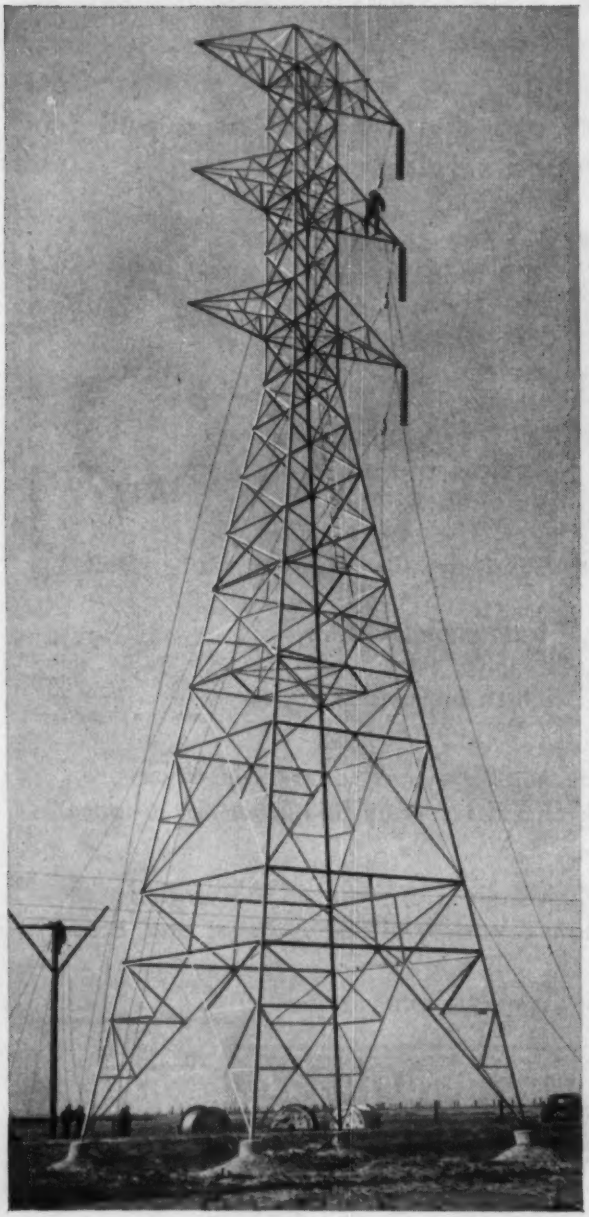
•

Test switch shelves, if required, are drilled to accommodate a variety of test switches and blocks.

Send for Complete Information

ANCHOR MANUFACTURING CO.
MANCHESTER, NEW HAMPSHIRE

All-Aluminum Conductors ADD CAPACITY,



Stringing Reynolds All-Aluminum Conductor on a PG&E tower. This tower can support lines carrying more capacity when the conductor is lightweight all-aluminum.

All-aluminum conductors are not new to Pacific Gas and Electric, with some 3,000 circuit miles of these cost-cutting conductors in service. Most of PG&E's all-aluminum line is in light loading areas, on 60, 70, 110 and most recently, on 220 kv systems. On one section of a recent San Joaquin Valley installation, PG&E used 1,113,000 CM Reynolds All-Aluminum Conductor for 220 kv transmission—*one of the largest conductors for the highest voltage in the PG&E system.*

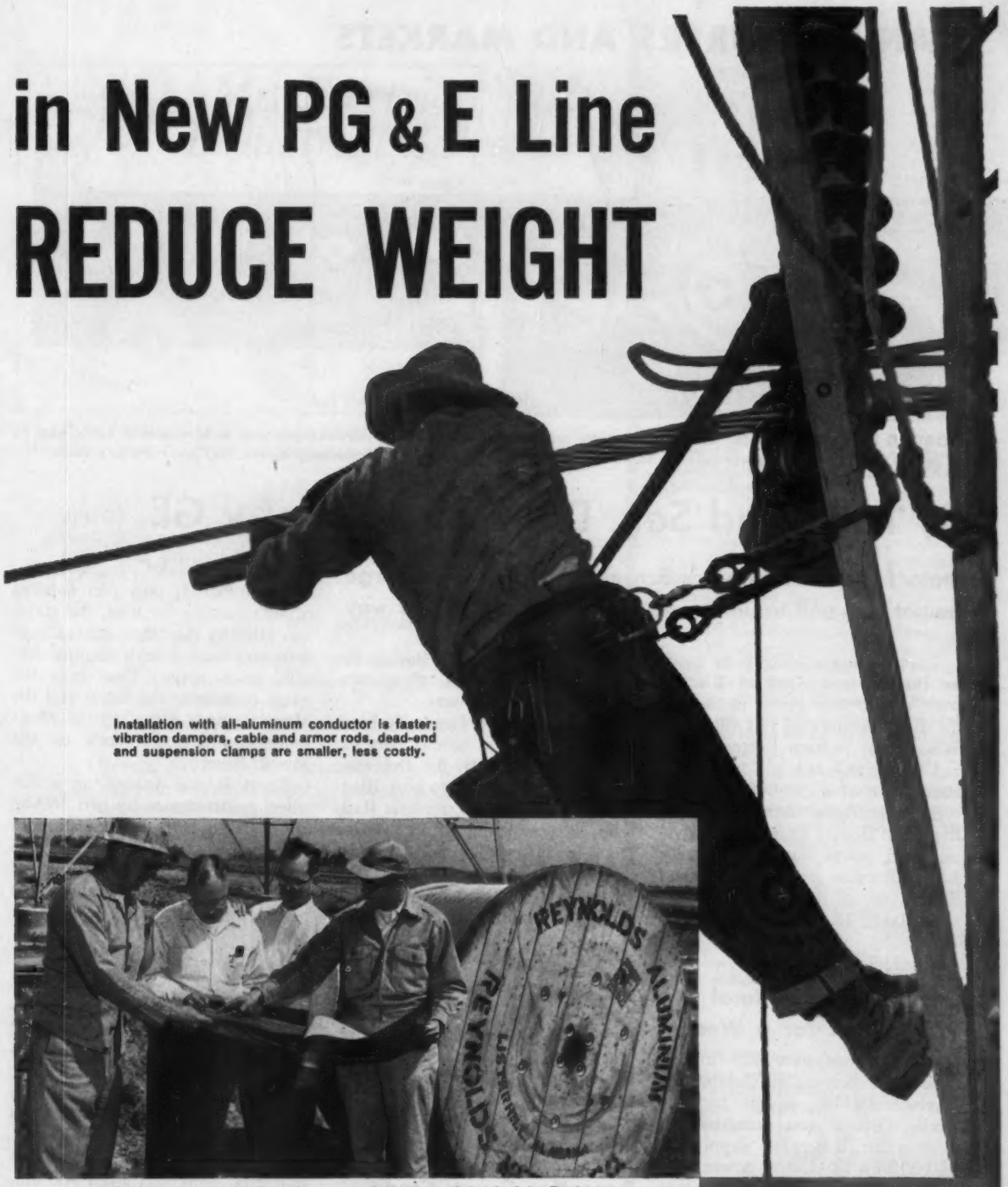
How you can save with Reynolds All-Aluminum Conductor

Tough, lightweight Reynolds All-Aluminum Conductor for use in light loading areas is not only economical but also saves in labor, fittings and installation. Towers reflect savings because they are designed for less stress than with heavier conductors. Cable and armor rods, dead-end and suspension clamps, vibration dampers are all smaller and cost less. And, of course, the lighter all-aluminum conductor costs less to ship and handle.

Reynolds Engineering Service Helps

Reynolds Engineering Service—available to you in your office and in the field—is an important plus in helping you get maximum benefit from the Aluminum you use. For full details on Reynolds All-Aluminum Conductor, ACSR, Covered Conductor and other products for the electrical industry, contact your nearest Reynolds Electrical Distributor, Reynolds Branch Office or write *Reynolds Metals Company, P.O. Box 1800-EL, Louisville 1, Kentucky.*

in New PG & E Line
REDUCE WEIGHT



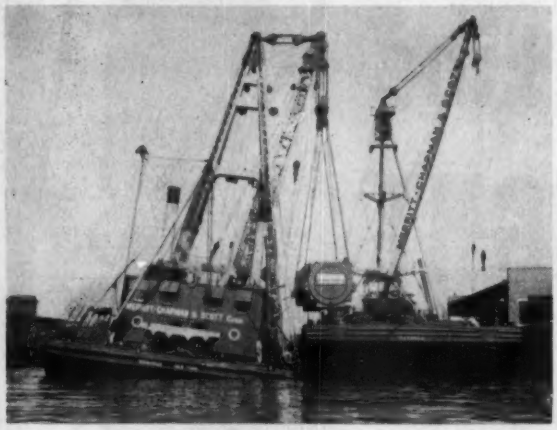
Installation with all-aluminum conductor is faster; vibration dampers, cable and armor rods, dead-end and suspension clamps are smaller, less costly.

Looking over construction plans on the job site are (l. to r.): John Fischer, PG&E General Foreman; Art Coburn, Reynolds Engineer; Harold Adams, Reynolds Electrical Conductor Supervisor and Elwyn G. Lambert, PG&E Supervising Electrical Engineer.

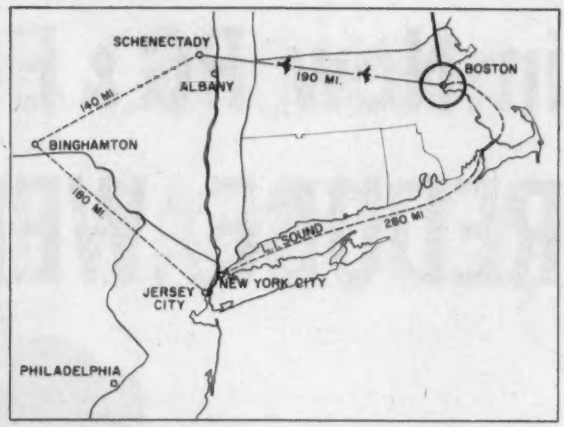
REYNOLDS ALUMINUM

See "CIRCUS BOY", Reynolds exciting dramatic series, Sundays, NBC-TV

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM



FLOATING DERRICK "Monarch" lifts 233-ton stator on barge at Jersey City, start of tugboat journey to Boston



MAP SHOWS advantages that a bird would have had in taking the Schenectady-Boston trip over stator's route

By Land and Sea, Delivery Made by GE

Stator travels 600 miles from Schenectady to Boston by barge, freight car, and trailer truck, going 400 miles out of way.

Transporting a 467,000-lb stator to Boston took General Electric over a 600-mile route instead of the direct distance of 190 miles that Schenectady is from Boston.

Utilizing rail, sea, and trailer, the stator, part of a 140,000-kw steam turbine-generator unit, was delivered to Boston Edison Co's Mystic River power station at Everett, Mass. Because of the weight and dimensions of 13 ft high, 12 ft wide, and 27 ft long, a special route had to be found having the necessary load limits, clearances, and railroad right-of-way.

From the Large Steam Turbine-Generator plant in Schenectady the stator was carried by the Delaware and Hudson Railroad to near Binghamton. Loaded on the Erie Railroad, it was taken to its Marine Dock in Jersey City, N. J. While traveling by rail, the stator was restricted to a maximum speed of 30 mph and could only travel when the adjacent tracks were clear.

From Pier 1, only pier capable of withstanding the load, the stator was lifted by the "Monarch", Chapman and Scott Corp's floating derrick, on a barge. Then both the barge containing the stator and the Monarch were towed to the Monsanto Chemical Co dock on the Mystic River.

There it was loaded on a 32-wheel trailer drawn by two 300-hp diesel trucks. On this last stage of the journey, streets had to be shorn up with some 25,000 board-feet of lumber to prevent breaking the pavement.

C-E Boiler Sales Total $25 Million for 6 Weeks

Contracts of over $25 million have been received by Combustion Engineering, Inc, in the past six weeks. Orders were placed by four utilities for boilers to supply 1,270,000 kw of electric power.

Significant in these orders was the fact that they represented first purchases by the companies of controlled circulation boilers, reported Donald S. Walker, vice president and director of sales.

Orders were placed by the following: Consolidated Edison of N. Y., Inc, 340,000-kw unit for Astoria Station; Florida Power & Light Co, two 240,000-kw units for Port Everglades Station; Pennsylvania Power & Light Co, 330,000-kw unit for a plant near Harrisburg; and Florida Power Corp, 120,000-kw unit for P. L. Bartow Station, St. Petersburg.

Argentine Grants Credit for Generator Imports

BUENOS AIRES—(McGraw-Hill World News)—Granting of credit for financing imports of electrical generators for industrial use has been authorized by the Argentine Central Bank.

This move, in a period when credit is being carefully restricted as an anti-inflation measure, is made in an attempt to alleviate the shortage of electric power. Credits will cover up to 70% of the cost of generators and subsidiary installations and will also be granted to industry for purchase of locally manufactured generating units.

At the same time, the Argentine Industrial Bank was given 300 million pesos ($16.7 million at the official 18 to 1 exchange rate, or about $7.5 million at the free market rate) to help power cooperatives install generating equipment. The Industrial Bank loans will cover 100% of generator cost and 80% of cost of subsidiary equipment.

(*More M & M on page* 126)

Mr. Electric Utility Industrial Salesman

How do YOU live with these facts?

Any voltage variation

from nameplate rating of an electrical device causes a sacrifice either in life or performance of the equipment.

Minor voltage fluctuations

applied to automatic control devices can nullify the most costly engineering and design investment and can ruin work in process worth many times the cost of proper automatic voltage regulation equipment.

A ten percent undervoltage

results in:

- . . . 19% decrease in heat output of resistance heaters.
- . . . 20% decrease in fluorescent lamp life and 15% decrease in light output.
- . . . 19% decrease in starting and maximum running torque of induction motors.
- . . . drastic reduction in electronic tube life.
- . . . sluggish solenoids and timers that result in rejects and process re-cycling.

Each five percent overvoltage

reduces the cathode life of electronic tubes by 50% . . . shortens life of mercury vapor lamps by overheating . . . affects lamp transformers.

A ten percent overvoltage

results in:

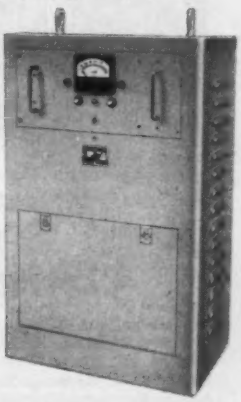
- . . . 10 to 12% increase in induction motor starting current, increasing torque, and causing lighting to flicker.
- . . . 70% reduction in incandescent lamp life — tripling lamp replacement costs.
- . . . 20% reduction in fluorescent lamp life.
- . . . 20% reduction in corrective capacity of capacitors thereby losing the benefit of 20% of the capacitor investment.

These are facts of life that can haunt a conscientious, hard-working Public Utility Industrial salesman.

They can be creating those constant, annoying troubles whose cause frequently cannot be traced — but for which you have your hat pulled down over your eyes by irate customers.

Even though these troubles may not be the result of generating or transmission faults, it is still tough to admit your product isn't perfect — or is it? Plant management today is learning more and more about *Varying Voltage Troubles*. It is high on their check list of troubles. They look to you to spot this troublemaker first — *and recommend the use of a good automatic voltage regulator.*

For all industrial production or laboratory uses of 100 KVA or less, you'll find a mechanically rugged and control sensitive STABILINE Automatic Voltage Regulator ideal for the job. Carry a STABILINE bulletin in your brief case. It will help you live with a lot of problems that previously haunted you. It will help you build more solid customer relations.



STABILINE holds output voltage constant . . . and ends production troubles caused by voltage variations.

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Please send STABILINE Bulletin S657 ☐ Have your representative call ☐

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ALL LINE CLEARING MADE SAFER!

Speed work, cut labor costs and protect workmen against injury. 36" swivel blade tensioned by bent wood bow. Friction reduced by narrow saw blade. Overall length of working section is 5 ft., fitted with ferrule for adding sectional poles extending to any length.

Write for catalog illustrating insulated tree trimmers, hand saws, tree paint, safety saddles, tree bracing materials and complete line of tree surgery tools.

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Are you missing something in **Electrical World?**

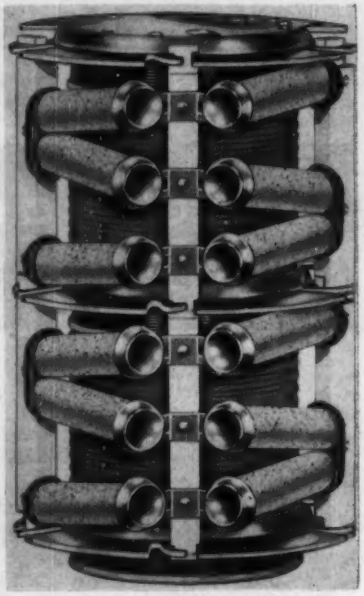
Right now, **have a look at the complete, compact, 2-minute summary of the book, printed on special yellow stock at the front. Here is *the gist* of what's going on in the industry! "Newscope" covers future and late news; "Electrical Week" examines events, generation, distribution, commercial, management, people, manufacturing, and new equipment; "Engineering Trends" briefs *that* aspect of issue content. This specially written summary in the front of each issue, on yellow stock for easy finding, gives you *the complete overall picture of the industry and everything affecting it for the past week!* It mirrors the contents of each issue for absorption almost at a glance – let's you invest your Electrical World reading time more profitably.**

O-B Features Dynagap in Arresters

A new line of Thorex lightning arresters is being produced by Ohio Brass Co, Mansfield, Ohio. Featuring a design principle of series gap structure, called Dynagap, the arrester allows almost a 90% transfer of power-follow current limiting resistance, and duty, from valve blocks to the series gap element.

Pictured at right is a 9-kv section of station type gap structure that provides 66 in. of linear arc interruption distance. Incorporation of the Dynagap has made possible a new order of durability and resistance to the influence of surface contamination, combined with drastic size reduction in station type models, according to a company spokesman.

The smaller size permits correspondence of the dimensions of the arresters with equivalent NEMA switch insulator stacks and also the use of electrically continuous housings. Elimination of stacking units in high-voltage arresters is said to remove the cause of arrester damage due to surface contamination



leakage currents.

Further advantage of Dynagap, which will be available in August, is its small size for interchangeable use with all arresters of the Thorex line.

Kaiser Steel Pipe Tested Under Pressurized Gas

Kaiser Steel Corp electric weld pipe is tested for gas-tightness before final installation in Pacific Gas & Electric Co underground high-voltage cables in San Francisco.

Inside the 6.625-in. electric weld pipe, filled with nitrogen under pressure, high-voltage lines are laid. The high-voltage cable is insulated with ½-in. thickness of paper. More than 8 miles of line, capable of carrying 110 kv, is being laid at the cost of approximately $2 million.

In the test shown, a water jacket is put around the pipe while it is filled with pressurized gas. Any bubbles will indicate defects in joints.

SMUD Awards Contract

Federal Pacific Electic Co of San Francisco has received the Sacramento Municipal Utility District contract of $1,060,800 for switchgear and structural equipment for a 420,000-kva Hedge substation near Florin, Calif. Equipment delivery is scheduled for May, 1958. Power from the SMUD Upper American River Project will be delivered to the substation, which will serve as a major interconnection between the electrical systems of the district, the Central Valley Project and the Pacific Gas & Electric Co.

SAVE TIME and MONEY!
WITH A
6" FIELD RANGE FINDER

. . . Widely used by 'Phone and Utility Companies

Speed erection and maintenance of Telephone and Utility lines with this 6" Field Range Finder. Measure line clearance, spacing and sag from the ground. Measure distances from 8 ft. to 100 ft. with accuracy to within 2%. Especially useful for inaccessible objects and places. These are sturdily built instruments . . . of such compact size they're easily carried in pocket. Dependable for years of trouble-free service in rugged use. Available in two models — Direct Vision and Overhead Prism. Each supplied with a top-grain genuine leather carrying case. Order by Stock Number. (open account to rated firms).

Stock No. 50,137-DK
Direct Vision Model $32.50

Stock No. 50,138-DK
Overhead Prism Model $43.00

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Barrington, New Jersey

your future is in your hands

Right now you're holding the one *basic* reference in the electric power industry. Used regularly, it can help you, as it helps more than 26,000 others in all capacities to do a better job, get ahead faster. Get the ELECTRICAL WORLD habit.

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P. O. Box 1581 Okla. City

Thoroughly Specialized
RIGHT-OF-WAY ACQUISITION
From Title Search . . . To Damage Claims

Electrical Manufacturing Increases 60% in Canada

Electrical manufacturing increase in Canada has been 60% greater since 1946 than that of all the nation's manufacturing, declared J. W. Kerr, vice president and general manager of apparatus products, Canadian Westinghouse Co, Ltd. He spoke at a regional conference of the Illuminating Engineering Society.

Taking into account inflationary adjustments, this is an increase of 325% in the ten year period. Also during this time production of light bulbs tripled.

A 52% increase in generating power to 23 million kw by 1962 is predicted by Kerr. By 1975 generating capacity should be 70 million kw with load growth at an annual rate of 8.5%. Production of motors was forecast to be at the rate of 6.25 million hp per year compared to present 1.25 million hp.

Westinghouse Ships Generator to Hells Canyon

Part of a waterwheel generator stator is starting on its way from the Westinghouse Electric Corp.'s East Pittsburgh plant to a project in Hells Canyon.

This 50-ton section along with two identical units will form the stator for the 100,111-kva generator at the Idaho Power Co Brownlee Station, Robinette, Ore. At the Brownlee Station four generators rated at 90,100 kw will be installed, with four smaller, 47,500-kw, Westinghouse generators at the Oxbow station, also on the Snake River.

Specialists IN INDOOR-OUTDOOR ENCLOSURES, SWITCHES AND TEST BLOCKS
KNIFE-TYPE, REMOVABLE LINK & SLIDE-A-LINK SWITCHES
Makers of the safe, sturdy, compact,
Roto-Test
2 POSITION TRANSFER OR CONTROL SWITCH
WRITE FOR LATEST BULLETINS
METER DEVICES COMPANY
1001 Prospect Ave. S.W.
CANTON, 6, OHIO

WRIGHT SAFEWAYS
Your Best Buy for Rigging and Maintenance Work

12 Sizes
½-ton to 50 tons

Bulletin 412A gives complete details on the many outstanding features that make Wright Safeways your best buy for long, trouble-free life. Write York, Pa. for your copy.

Some Safeway Features

Load Chain is finest alloy, every foot proof-tested . . . heat treated for hard wear-resistant working surface . . . ductile to withstand shock loads . . . "wick" lubricated . . . anti-rust zinc coat.

Load and Idler Sheaves rotate on life-lubricated, antifriction bearings . . . minimum of 5 pockets in Big Sheaves for efficiency and long life.

Gears, Pinions, Drive Spindle (also top and bottom Hooks) are nickel-chrome-molybdenum alloy steel mounted on heavy-duty, antifriction bearings. *Gear Train* is enclosed in oil-tight chamber.

Load Brake is Weston type, silent, dependable.

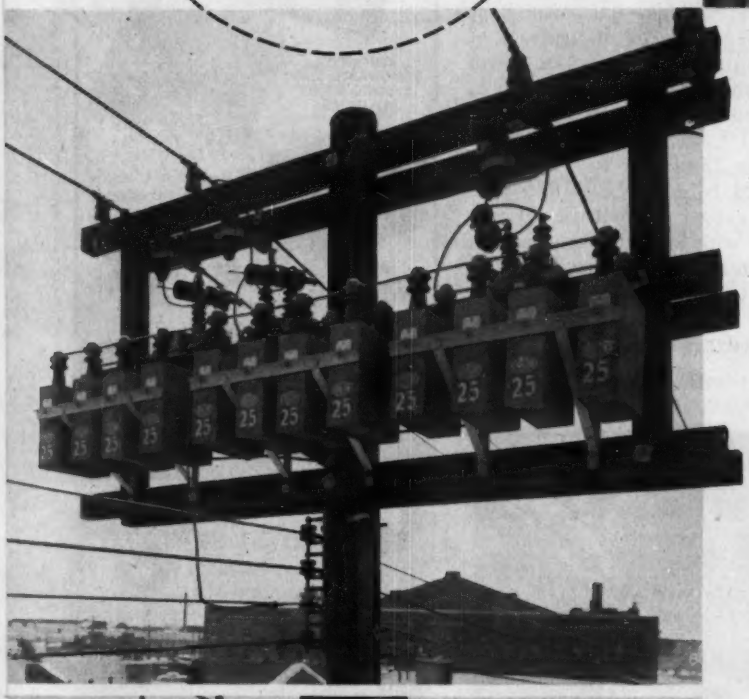
Steel Housing fully protects vulnerable parts.

ACCO

Wright Hoist Division
AMERICAN CHAIN & CABLE
York, Pa., Bridgeport, Conn.

Sangamo
Capacitors
"APPROVED"
by more and more
major utilities!

Dielectric packs are wound of special kraft paper and pure aluminum foil. Atmospheric conditions are controlled to eliminate any danger of contamination.



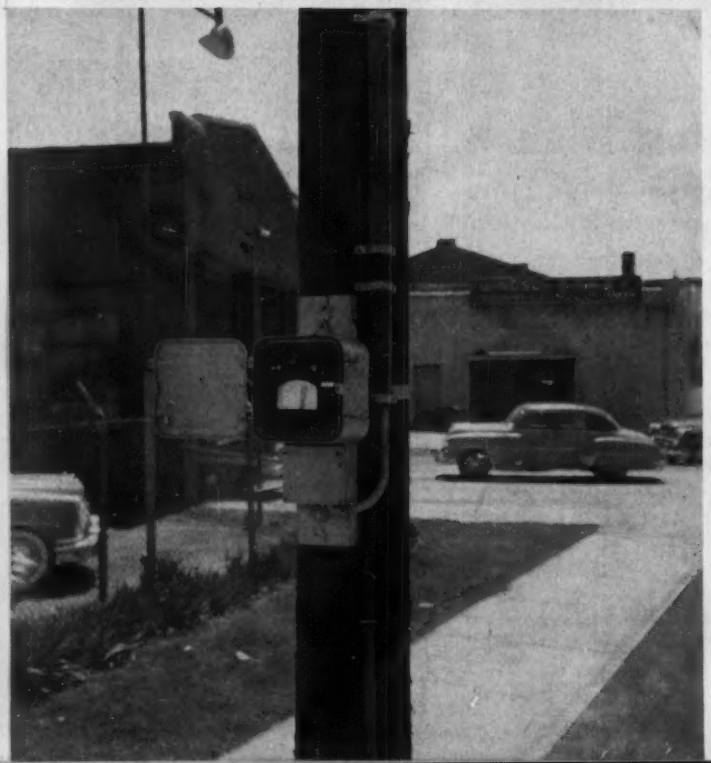
Constant care in longer service

Sangamo Power Capacitors are built to rigid specifications to meet power engineers' requirements for stable performance and long service life.

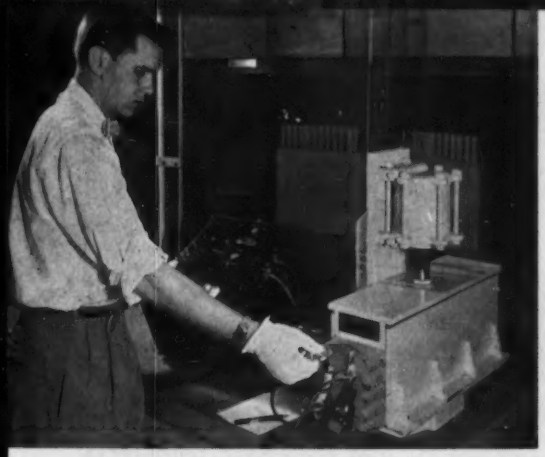
Rigid quality control of raw materials . . . constant care in every step of manufacturing . . . thorough testing and inspection . . . are all part of these specifications.

These capacitors are built in one of the country's most modern "controlled conditions" manufacturing plants. Dust is filtered out of the atmosphere to eliminate danger of contamination. Temperature and humidity are controlled to assure product uniformity.

The power engineers of many major utilities have inspected Sangamo's processing facilities, some of which are shown on these pages, and

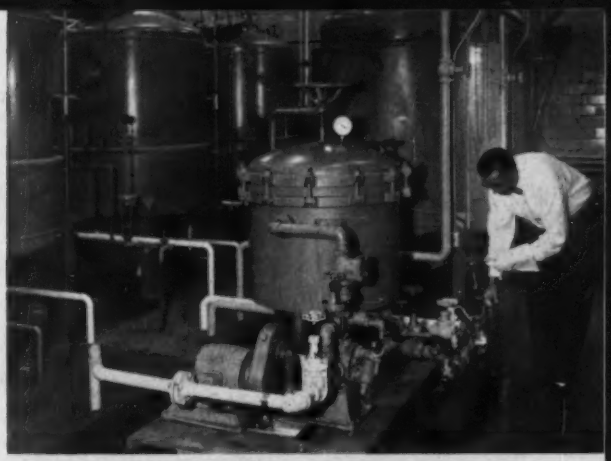


This bank of 25 Kvar Sangamo Capacitors is controlled by the voltage type Sangamo VC Lincolntrol shown below. The service is 2400/4160 Y grounded neutral with capacitor cases and Lincolntrol tied in with ground.



Specific tests precede and follow almost every processing operation. Here dry rolls are being measured for capacitance and power factor.

Sangamo Diaclor, the liquid dielectric used in these capacitors, is purified here. Great care is taken to maintain its purity.



Sangamo's facilities are geared for quantity production. Here is one of the capacitor vacuum impregnating tanks.

production means on your lines

have put Sangamo Capacitors on the "Approved List" of their respective companies. Sangamo Power Capacitors are available in 15, 25 and 50 Kvar units, in all primary voltage ratings, and in factory-assembled and wired Auto Var equipments for pole-type installation.

Sangamo also manufactures Lincolntrols and Time Switches for automatic capacitor control as a function of time, volts, amperes, watts, or vars—or as combinations of these functions. Look to Sangamo for all your capacitor requirements ... visit our plants ... inspect our facilities. Ask your Sangamo Representative, or write us for complete information.

Each unit is tested for overvoltage, capacitance, power factor, and radio noise in a completely shielded test booth. Capacitance and power factor measurements are made at rated voltage and frequency with a high-precision bridge.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

After final inspection and tests, the completed capacitors come off the assembly lines and are packaged for shipment to you.

MEETINGS CALENDAR

JULY

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, July 18.

Southeastern Electric Exchange—Personnel Administration Section Conference, John Marshall Hotel, Richmond, Va., July 25-26.

AUGUST

Western Electronic Show and Convention—Annual Meeting, Cow Palace, San Francisco, Calif., August 20-23.

• **Electric Companies Advertising Program**—Copy Group Meeting, Seaview Country Club, Absecon, N. J., Aug. 22.

American Institute of Electrical Engineers—Pacific General Meeting, Pasco, Washington, Aug. 26-30.

SEPTEMBER

American Institute of Electrical Engineers—2nd Special Technical Conference and Exhibit on Magnetic Amplifiers, Hotel Penn Sheraton, Pittsburgh, Pa., September 4-6; Sixth Annual Industrial Electronics Symposium, co-sponsored with Institute of Radio Engineers, Morrison Hotel, Chicago, Ill., Sept. 24-25.

Instrument Society of America—12th Annual Instrument Automation Conference and Exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 9-13.

Illuminating Engineering Society—National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Electric Companies Public Information Program—Steering Committee, New York City, Sept. 11; Workshop Conference, Whittier Hotel, Detroit, Mich., Sept. 25-27.

Maryland Utilities Association—33rd Annual Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 13-14.

Edison Electric Institute—Accounting Division Organization Meeting, jointly with AGA, Lemington Hotel, Minneapolis, Minn., Sept. 19-20; Industrial Relations 10th Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 23-25; Meter & Service Committee, Hotel Nicolet, Minneapolis, Sept. 23-25; Electrical Systems and Equipment Committee, Cosmopolitan Hotel, Denver, Colo., Sept. 30-Oct. 1.

Public Utilities Association of the Virginias—39th Annual Meeting, White Sulphur Springs, West Virginia, Sept. 19-21.

American Society of Mechanical Engineers—Fall Meeting, Statler Hotel, Hartford, Conn., Sept. 23-25.

Electric Companies Advertising Program—Copy Group Meeting, Detroit, Mich., Sept. 25.

OCTOBER

Pennsylvania Electric Association—50th Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 2-3.

Indiana Electric Association—French Lick-Sheraton Hotel, French Lick, Ind., Oct. 2-4.

International Association of Electrical Leagues—Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, October 2-5.

National Industrial Conference Board—Atomic Energy Course for Management, Hotel Moraine on the Lake, Highland Park, Ill., Oct. 6-12.

• **Iowa Utilities Association**—Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, Oct. 7-8.

• **National Electronics Conference**—13th Annual Meeting, Hotel Sherman, Chicago, Ill., Oct. 7-9.

American Society of Mechanical Engineers—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Royal York Hotel, Toronto, Canada, Oct. 7-9; Power Conference, Americus Hotel, Allentown, Pennsylvania, Oct. 21-23.

National Electronics Conference, Inc—Hotel Sherman, Chicago, Ill., Oct. 7-9.

American Institute of Electrical Engineers—Fall General Meeting, Morrison Hotel, Chicago, Illinois, October 7-11.

Edison Electric Institute—Area Development Workshop, Phoenix Hotel, Lexington, Ky., Oct. 9-11; Transmission & Distribution Committee, Statler Hotel, Boston, Mass., October 17-18; Accounting Division Taxation Accounting Committee, held jointly with AGA, Williamsburg, Va., Oct. 23-24.

Rocky Mountain Electric League—54th Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., Oct. 13-17.

Interstate Power Club—Hotel Martinique, New York City, N. Y., October 14.

Oklahoma Utilities Association—Electric Light and Power Division, Woodward, Okla., Oct. 25; Eastern District, Bartlesville, Okla., Oct. 25.

Atomic Industrial Forum—Annual Conference, New York City, Oct. 28-30.

American Nuclear Society—Winter Meeting, New York City, Oct. 28-30.

National Association of Railroad Utilities Commissioners—Annual Conference, Peabody Hotel, Memphis, Tennessee, October 28-31.

Industrial Management Society—21st Anniversary Industrial and Management Clinic, Hotel Sherman, Chicago, Ill., Oct. 30-Nov. 1.

Institute of Radio Engineers—3rd Annual Technical Conference of the Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C., Oct. 31-Nov. 1.

NOVEMBER

Edison Electric Institute—Accident Prevention Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 6-8.

Pacific Coast Electrical Association—Hawaiian Conference, Reef Hotel, Honolulu, Hawaii, Nov. 7-8.

Institute of Radio Engineers—Third Annual Instrumentation Conference, Atlanta Biltmore Hotel, Atlanta, Georgia, Nov. 11-13.

National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

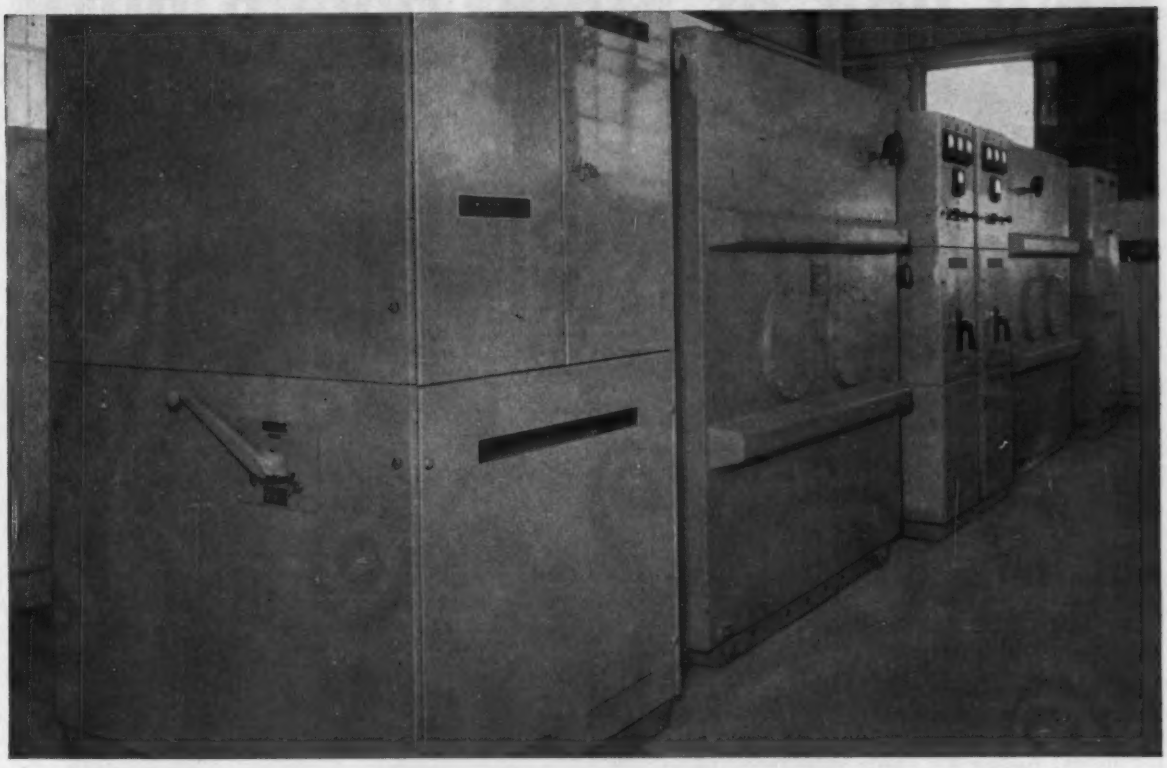
Electric Companies Public Information Program—Inter-Regional Committee, Mayflower Hotel, Washington, D. C., Nov. 19.

• Additions this week.

Duke Power Seeks Hydro Project Okay

Duke Power Co has asked for FPC's approval to build a three-generator, 262,500-kw hydro project on the Catawba River near Cowan's Ford. It would cost approximately $54 million.

WAGNER TRANSFORMERS . . . THE CHOICE OF LEADERS IN INDUSTRY



Wagner Sealed Dry-Type Transformers can serve under the most adverse conditions

Impervious to DUST, LINT, HUMIDITY, HIGH AMBIENT TEMPERATURES, FLOODING—no need for vaults or barriers

Here's a unit substation transformer that you can safely install in any load center—any place—no matter how tough the operating condition.

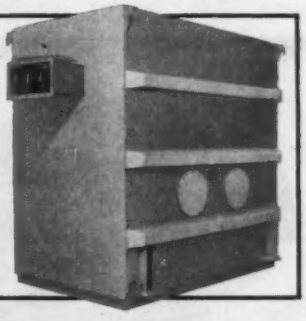
Wagner Sealed Dry-Type Transformers are hermetically sealed in a welded steel case to provide positive protection from contamination, fire and explosion hazards.

Class H insulation is used throughout the transformer. Core and coils are impregnated with silicone varnish and are sealed in the case which contains inert-dry-nitrogen under pressure to prolong insulation life. Maintenance is reduced to periodic checking of bushings case and gas pressure.

Available in ratings from 300 to 2000 kva, 5 or 15 KV high voltage, 480 volts low voltage. For complete information on these sealed dry-type transformers, write for Bulletin TU-214 or call the Wagner branch office near you.

PREDESIGNED
to save you money

Wagner Nitrogen-Filled Dry-Type Transformers save you individual job engineering time and cost. That's because they are PRE-DESIGNED in standard ratings coordinated with the specifications of unit substation switchgear builders. These standard designs assure quicker delivery of the correct transformer for your load center installation.



Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

737-11

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

New line of Alcoa heavy-duty, eliminates all loose parts

Three new extruded, parallel groove clamps handle #2 to 400MCM conductor—Economically priced

Are your men always dropping or losing the nuts and washers from old-fashioned clamps? End fumbling loose parts. Here's the answer: Alcoa's new heavy-duty universal clamps—all loose parts have been eliminated. They can be applied without being taken apart.

These new clamps also reduce inventories. A newly developed universal groove design allows just three clamps to cover the full ACSR range from # 2 to 397.5MCM (18/1), stranded from # 2 to 400MCM. They're competitively priced heavy-duty clamps.

Top and bottom parts of the clamps are Alcoa® Aluminum Extrusions—made strong, solid, dense, with a heat-treated alloy. Being wrought metal, tapped bolt holes have strong threads. Bolts are anodized to reduce thread friction. All parts are aluminum to equalize expansion, eliminate corrosion. Grooves are specially treated and coated with No-Ox-Id.

Experience gained during a quarter century of making parallel groove clamps has been applied in designing these new heavy-duty universal clamps.

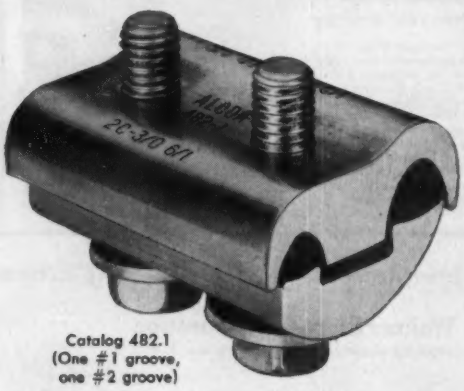
Months of extensive laboratory testing have proven these heavy-duty clamps. They have undergone 1,000 heat cycles using various conductor combinations; test current produced conductor temperatures of 200° F—without significant change in connection resistance.

Your Alcoa representative has samples of these clamps and full details. Let him show you how they can reduce your inventory, help on your connecting problems, make your men's work easier. Or write ALUMINUM COMPANY OF AMERICA, 2306-G Alcoa Building, Pittsburgh 19, Pa.

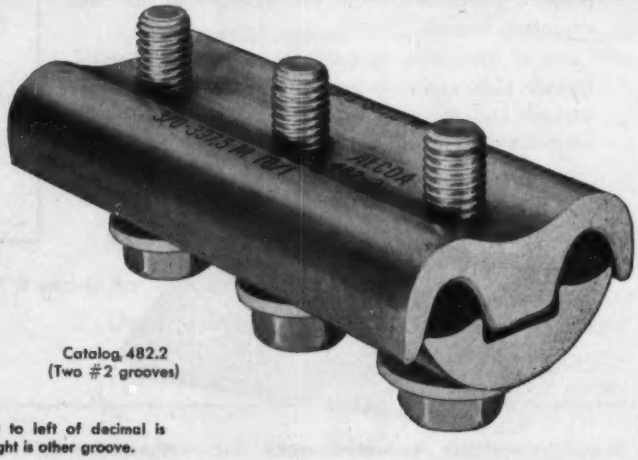
THE ALCOA HOUR—
Television's Finest Live Drama—Alternate Sunday Evenings

ALCOA ALUMINUM
CONDUCTORS & ACCESSORIES
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value



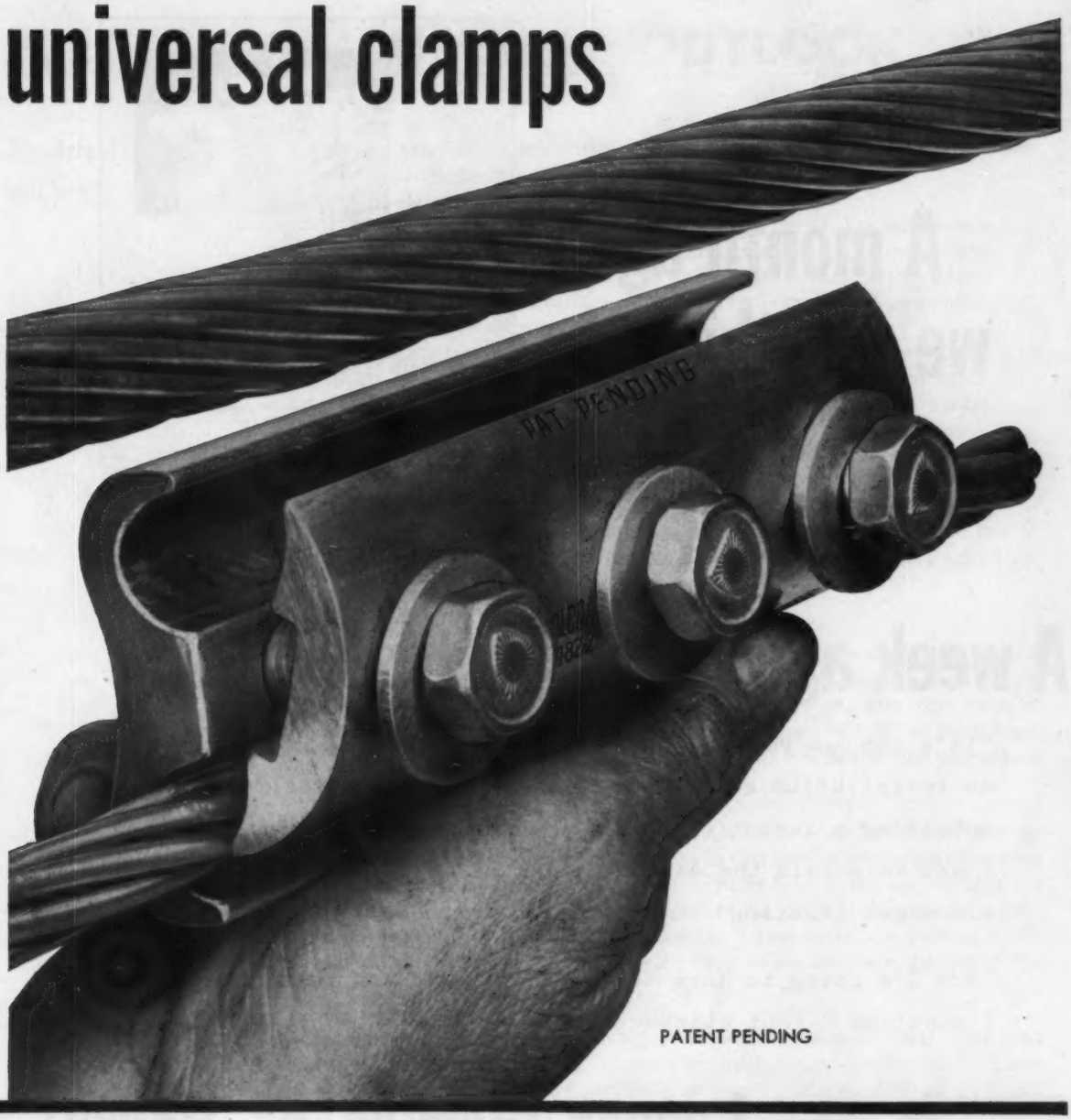
Catalog 482.1
(One #1 groove, one #2 groove)



Catalog 482.2
(Two #2 grooves)

Functional catalog numbers: digit to left of decimal is number of one groove; digit to right is other groove.

universal clamps



PATENT PENDING

Catalog 481.1
(Two #1 grooves)

RANGE OF CONDUCTOR FOR EACH GROOVE SIZE

Groove Size	Dia. Min.	Range Max.	ACSR Min.	ACSR Max.	Stranded Conductor Min.	Stranded Conductor Max
1	.292	.502	2 (6/1)	3/0 (6/1)	2	3/0
2	.464	.743	3/0 (6/1)	397.5MCM (18/1)	3/0	400MCM

(See captions under clamps)

A month ago we ran this ad

"This kit helped me sell three lighting jobs worth $1,300 . . . all the same day"

New General Electric "Plan-It-Yourself" Lighting Layout Kit can help you sell More Lighting Jobs, Too!

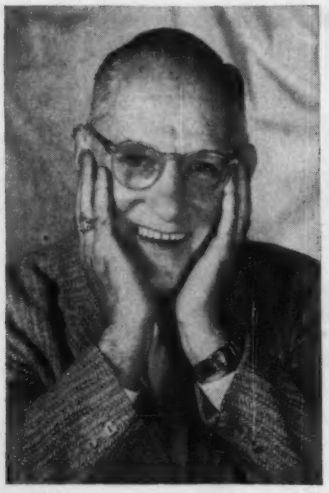
Progress Is Our Most Important Product

GENERAL ELECTRIC

A week ago Harry wrote:

"It's too bad you ran that ad so soon. I have since completed an installation of 23 four-lamp, 8-foot fixtures, and then submitted a layout of 44 fixtures for a supermarket addition. I not only sold the 44, but an extra 56 as well to replace the old store lighting! That's $6,500 worth of lighting business!

"Now I'm going to have to re-read the ad and buy another kit. I'm out of 8-foot stickers!"



Latest picture of Harry!

(And who wouldn't smile? According to Harry, "that $6,500 means a profit increase of about 500%!")

This new General Electric "Plan-It-Yourself" Lighting Layout Kit can help you sell more lighting jobs, too—so get yours today from your local G-E Lamp Supplier. Or send $1.75 to: General Electric Co., Large Lamp Dept. EW-77, Nela Park, Cleveland 12, Ohio. There are still a few kits left!

Progress Is Our Most Important Product

GENERAL ELECTRIC

ELECTRICAL BUSINESS OUTLOOK

Electrical World
JULY 15, 1957

Here are the price increases that will set the pattern for electrical equipment manufacturers—in case you missed the staggered announcements:

> **General Electric Co**—4% on transformers above 500 kva and on substation, network, load, and distribution center transformers; 4½% on electrical apparatus repair; 5% on large and medium steam turbine-generator units, metal clad switchgear and switchboard assemblies; 7% on high-voltage switchgear; 10% on gas turbines.
> **Westinghouse**—5% on steam turbine-generator units, mechanical drive turbines and accessories, renewal parts, and heat transfer equipment; 10% on gas turbine department products; 2.6% for voltage regulators; 4% on most transformers and reactors; 5% on switchgear; 7% on fuses and breakers (see p 19).

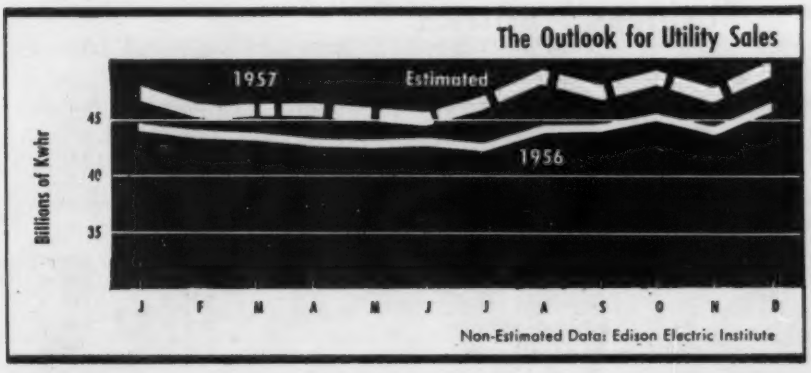
Virtually all makers of electrical items will follow suit, observers believe. Impact of higher steel costs, the wage boosts contracted for last year or tied to cost-of-living index, and higher price tags on materials manufacturers need are the reasons given for adjustments.

• • •

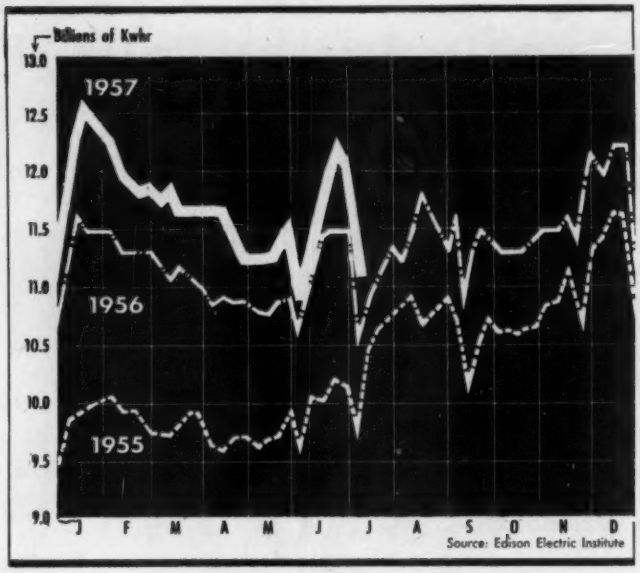
In case you hadn't noticed, profits have been doing well this year. For the first half of '57, total corporate profits (after taxes) have been running at an annual rate of more than $23 billion. That's better than last year, better than 1955, in fact better than any time since the tax rate was upped to 52% in the Korean War days. And for a year that was supposed to run into a tight squeeze on earnings, it's been a very healthy sign.

There is something new in the profits picture, however and it ties in with growing competition. Some industries and companies that used to be profit leaders have been slipping lately; others that were doing badly have picked up. Usually it's complaints one hears. This tends to obscure the fact that there's been steady improvement in profit margins since last year's steel strike— a pick-up in oil, utilities, capital goods, and many retail lines which has more than offset the drop in other industries.

Inflation has tended to give profit figures an artificial boost, of course. But (and this is often overlooked) today's profits are more conservatively stated. Companies are not counting inventory gains as profits to the same extent as in past years. And larger amounts of depreciation, maintenance, and research are being charged off as current expense. So all in all—despite inflation and competition —this year's profits should look pretty good.



STATISTICS



OUTPUT

Week ended July 6,
11,056,000,000 Kwhr
Up 6.4%

Per Cent Change From Previous Year

	June 22	June 29	July 6
Total U. S.	+ 7.5	+ 5.3	+ 6.4
New Eng.	+ 8.3	+ 8.0	+ 0.7
Mid. Atlan.	+11.2	+ 7.9	+ 1.8
Cent. Ind.	+ 2.9	+ 2.4	+ 4.8
West Cent.	+ 0.1	− 0.6	+ 7.8
Southeast	+10.9	+ 7.2	+ 6.2
South Cent.	+ 9.5	+ 0.2	+11.1
Rocky Mount.	+ 3.4	+ 6.6	+ 7.7
Pacific			
NW	+ 7.7	+ 8.5	+ 8.7
SW	+11.0	+10.8	+13.5

Seasonally Adjusted Index 232.5
Week Ago 232.1
Year Ago 215.9

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 6.9%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity, Peak—Class 1 Systems, Estimated Dec. '57 Peak (million kw)	April	122.27	121.78	116.78	4.7
	April	97.7	98.0	91.6	6.7
	April	113.6	113.5	114.1	− 0.4
Production—billion kwhr	April	50.67	52.45	47.49	6.7
Hydro		12.05	11.44	11.55	4.3
Fuel		38.62	41.01	35.94	7.5
Sales—billion kwhr	April	47.15	47.75	44.58	5.8
Residential		12.72	13.47	11.86	7.3
Commercial		7.25	7.35	6.71	8.0
Industrial		24.66	24.44	23.60	4.5
Other		2.52	2.49	2.41	4.6
Fuel Consumption	April				
Coal—million tons		12.50	13.84	11.95	4.6
Oil—million barrels		6.47	6.57	5.76	12.3
Gas—billion cu ft		98.80	93.15	89.72	10.1
Net Income Class A & B Co's—$ million	April	115.93	126.81	114.54	1.2
Residential Customers—millions	12 mos.	45.99	45.92	44.67	3.0
Revenue per kwhr	ended	2.59¢	2.59¢	2.63¢	− 1.5
Avg kwhr per customer	Mar. 31	3,021	3,004	2,820	7.1
Avg annual bill		$78.23	$77.80	$74.17	5.5

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	May	143	144	141	1.4
ENR Construction Cost	July	151.8	151.2	145.6	4.3
BLS Cost-of-living	May	119.6	119.3	115.4	3.6
New Orders for Machinery (1950 = 100)	May	148	145	157	− 5.7
NEMA Sales					
Insulation materials	April	145	153	163	−11.0
Electric appliances		83	97	111	−25.2
Wholesale prices	April				
Motors and generators		141.4	140.7	130.4	8.4
Transformers and regulators		147.4	147.4	135.3	8.9
Switchgear and fuses		164.4	164.4	149.0	10.3
GNP—annual rate—$ billion	1st Qtr.	427.0	423.8	403.4	5.9%

MANAGEMENT BULLETIN

FINANCE

Heavy security offerings were made by electric utilities last week following the July 4th holiday. Central Illinois Light Co, Washington Water Power Co, and West Penn Power Co offered first mtg bond issues totaling some $65 million and Pacific Power & Light Co offered rights on 376,600 common shares on a 1-for-10 basis. Bids and reoffering prices are found on page 19.

Commonwealth Edison Co plans the public offering of between $25 million and $50 million in new securities early in October. Amount of the offering and whether it is in non-convertible preferred stock, debentures or mortgage bonds will depend on market conditions. Consolidated Edison Co plans to market $50 million mortgage at competitive bidding on Oct 22. If the market is weak the issue may be cut back, but a strong market may increase the issue to $60 million.

Stockholder subscriptions: A total of 541,937 shares of 609,815 common shares offered by Philadelphia Electric Co to its stockholders on a 1-for-20 basis at $36.25 a share, was taken via rights. Balance was disposed of by an underwriting group headed by Drexel & Co and Morgan, Stanley & Co.

Data book issued. West Penn Electric Co and subsidiary companies have just issued a booklet entitled "Historical Financial and Operating Data to Dec. 31, 1956." For copy write: Hugh D. McDowell, secretary, West Penn Electric Co, 50 Broad Street, New York 4.

REA loans; Plains Electric Generation & Transmission Cooperative, Albuquerque, N. Mex., has received a loan of $1,053,000 from the REA to complete construction of a third 16,500 kw steam generating unit at its Algodones plant and for other improvements to the system . . . REA has also approved a loan of $11.7 million to cover a 44,000-kw steam generating unit and 217 miles of transmission lines for Western Farmers Cooperative, Anadarko, Okla.

RATES

Florida Power & Light Co offers to file new rate schedules. Board Chairman McGregor Smith said that the offer to file a revised rate schedule did not mean, however, that the company agreed its rates were too high. Rather, he said, the company feared the consequences of a long rate battle on its plans to finance the expansion program during the next five years.

Blount (Tenn.) Electric System's utility board has reduced rates by $72,000 a year. Cut will average more than 10% and became effective after the first meter reading following June 30. System is the 62nd municipal and cooperative distributor of Tennessee Valley Authority power to reduce rates below the basic TVA level.

Empire District Electric Co is asking for rate increases of about 9% in the various states it operates in.

LEGISLATION

Maine: Legislature passes an act permitting reimbursement of utilities in cases where federal participation of 90% or more in highway development affects relocation of facilities. Law becomes effective on August 28 . . . Legislature fails to pass a bill which would have limited merchandising by utilities.

PUBLIC RELATIONS

Two electric utilities get awards. Montana Power Co is presented with a bronze plaque "in appreciation of the loyalty and the leadership provided by Montana Power Co in Montana toward the development of freedom of enterprise in our industry." . . . The other is an award to Cincinnati Gas & Electric Co from the American Heritage Foundation. Company's entry in the "Register, Inform Yourself, and Vote" contest was judged the "Best Exhibit in the U.S." More

than 7,000 entries were submitted. CG&E was the only utility to receive the award. It is a reproduction of Arthur Szyk's illustration, "George Washington the Soldier" and has inscription citing utility for outstanding public service.

Washington Water Power Co wins a "National Recognition Award" from the Chamber of Commerce of the United States for 1956 for its "Better Service" program. The award was made "for broad, overall program of economic intelligence and evident unanimity of company support by all members of the organization."

Frank M. Tait, chairman of Dayton Power & Light Co, is the subject of a book, called "A Story of Accomplishment," which was written in tribute to his civic and industrial accomplishments. Book is a report of Tait's contribution to basic industries and emphasizes his philosophy of service. Separate chapters are devoted to his achievements in the utilities field, the pump company which took his name, and the Frank M. Tait Foundation for assistance to worthy causes.

ADVERTISING

Eye Catching Ads: In selling its rate increase to the public, Worcester County Electric Co uses an ad showing Reddy Kilowatt with the caption "For the First Time in My Life I'm Asking for a Raise in Pay . . ."—Worcester County Electric Co . . . "Another Skill in the Upper Midwest . . . High-production Precision Workers"—Northern States Power Co . . . "You'll Never Wash Dishes Again! (or dry 'em either) When you buy an Automatic Dishwasher"—Consolidated Edison Co of New York . . . "Face the Future Electrically with Reddy Wiring"—Houston Lighting & Power Co . . . "Electric's the Way to Cook Today"—Alabama Power Co.

Commonwealth Edison Co features "Little Bill" on tv. Three 20 second animated spots have been completed by Playhouse Pictures, Hollywood. Spots point out the economical use of electricity in lighting, entertainment (radio and tv), and appliances. Commercials all feature the cartoon character "Little Bill" and carry out the central theme—"Electricity costs less today, you know . . . than it did 25 years ago."

SAFETY

New York State Electric & Gas Corp adopts a safety educational program in an effort to prevent electric contact accidents to employees of construction contractors, well drillers, sign erectors, and highway maintenance departments, Homer H. Chapmen, division manager at Elmira, reveals. As a part of the program and to assist in the elimination of accidents resulting from equipment contact with overhead power lines, Chapman is mailing a letter with an enclosed safety kit of material to contractors for use in informing their employees of the possible hazards involved.

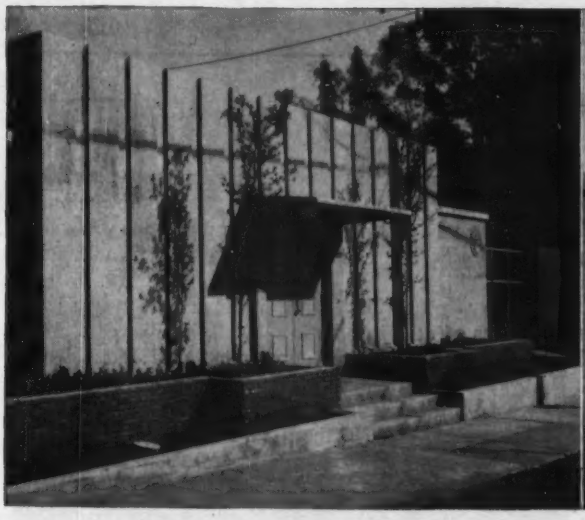
OPERATIONS

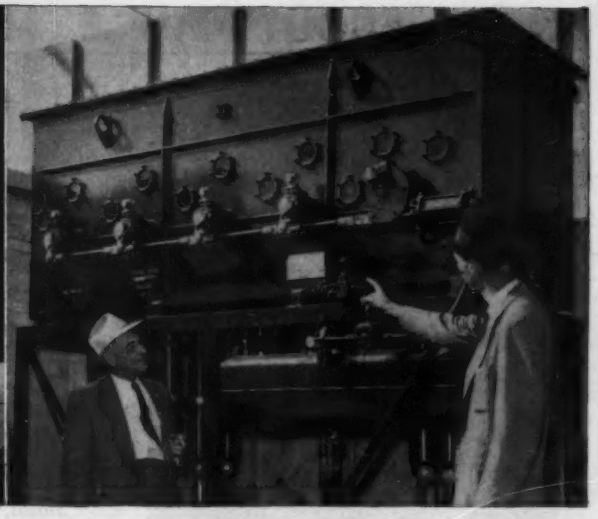
Toledo Edison Co plans to bring 960,000 tons of coal, about 90% of its needs, to Toledo by lake vessel this year. This is twice as much as was shipped by boat last year. Remaining 10% will be brought by rail.

Residential sales of the 22 PUD's in Washington averaged 8,753 kwhr at 1.06¢ per kwhr, according to the sixth annual tabulation of PUD electric system performance figures released by R. W. Beck & Associates, Seattle consulting engineers.

Options on 33,000 acres of southern Ohio coal lands in Vinton and Meigs counties have been acquired by the Ohio Power Co.

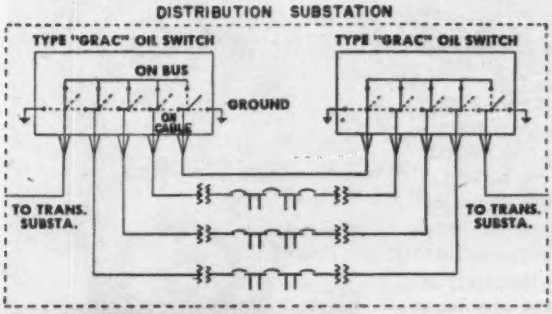
Indiana & Michigan Electric Co asks Indiana PSC approval to discontinue hot water heating service in the downtown Marion business district after the 1957-58 heating season.

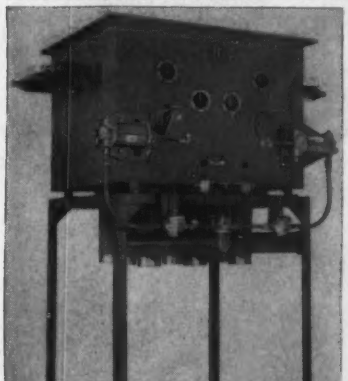




LOAD BREAK SWITCHING F-L-E-X-I-B-I-L-I-T-Y FOR 34.5 Kv. CIRCUITS

A large municipal utility installs a complete substation on a small city lot. Reduces maintenance to a minimum by eliminating all exposed buses, disconnects, etc. by using G & W Type "GRAC" oil switches.





Type "TGRAL" oil switch 3 way, 2 sets of links, 34.5 Kv. 400 ampere, full load break—with two pneumatic operating mechanisms. This and other styles of Type "RA" load break oil switches are available to provide safe sectionalizing at all voltages up to 34.5 Kv.

The G & W Type "GRAC" oil switches are 5 way, 34,500 volts, 400 amperes, with buses and 5 sets of switching links. The outer "ways" of each switch are for the feeder and feeder-tie cables and the three center "ways" are for cables to the load transformers.

A pneumatic mechanism, with manual control, provides for full 400 ampere load break at 34.5 Kv. Switching, therefore, can be done at the distribution substation without opening the circuit breakers at the transmission substations, which are located up to five miles away.

The oil switches and the feeder-tie cables facilitate energizing both ends of the double ended unit transformer stations from only one of the transmission substations during emergency conditions.

Ground positions for the two outer "ways" of each oil switch permit grounding the feeder and the feeder-tie cables. The center tap cables can be grounded also, by switching to the "ON CABLE" positions.

The one pneumatic mechanism on each switch is used for operating any of the five sets of links, by inserting a pin in the proper lever.

All switch cableheads are for single conductor gas filled cable stubs which are spliced to three conductor gas filled cables.

Send for series "D" bulletins. Get in touch with our nearest representative.

G & W ELECTRIC SPECIALTY COMPANY
3500 W. 127th ST., BLUE ISLAND, ILLINOIS

D575

Representatives in many cities of U. S. A., N. & S. America — Canadian Mfr. — Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

G & W

High Voltage Cable Terminating, Sectionalizing, Protecting, and Connecting Devices

POTHEADS • BOXES • OIL FUSE CUTOUTS • LOAD BREAK OIL SWITCHES • SPLICING KITS

Stultz Heads Potomac Ed

Potomac Edison Co has elected D. E. Stultz as its new president to succeed R. Paul Smith, who has retired. As chief executive of Potomac Ed, Stultz will also be president of Northern Virginia Power Co, the Potomac Light & Power Co, and the South Penn Power Co.

Stultz, executive vice president since 1953, has had experience in almost all phases of utility operation during his 38 years in the field. He started in the electrical department of Hagerstown & Frederick Railway Co, a Potomac Ed predecessor, in 1919. From his next job—that of line foreman at Berkeley Springs, W. Va.—he rose to district manager of Northern Va Power in 1924. Eight years later he was elevated to general commercial manager of Potomac Ed, and in 1937 was elected commercial vice president.

Smith, president for the past 25 years and a 50-year veteran with the system, is past president of Maryland Utilities Association and Southeastern Electric Exchange.

D. E. STULTZ

New Jersey Utilities Up Rose

Winn M. Rose, general superintendent of transmission for Jersey Central Power & Light Co, has been placed in charge of transmission of New Jersey Power & Light Co. He was named to succeed the late Roland P. Borden, former superintendent of transmission of NJP&L.

In his new capacity Rose will also be responsible for the meter departments of both companies and for the construction of major interconnections with other power companies.

Rose began his association with JCP&L in 1919. Since that time he has served in positions of increasing responsibility. He was appointed to the position of superintendent of transmission and distribution in 1946 and served in that capacity until January 1 of this year, when he became JCP&L's general superintendent of transmission.

WINN M. ROSE

Morthland Assumes BPA Post

J. Lane Morthland was recently appointed assistant administrator of the Bonneville Power Administration by Secretary of Interior Fred A. Seaton.

Morthland, termed an "ideal choice" by BPA Administrator William A. Pearl, has had a close working relationship with BPA during the past three years. In May 1954, he became general counsel for BPA, and in July of that year, when the solicitor's office was reorganized, he became Portland regional solicitor. Morthland was previously city attorney for Yakima, where he had a private law practice. He received his law degree from the University of Washington in 1934.

Morthland succeeds Byron Price, who recently resigned to become manager of the Eugene, Ore., Water & Electric Board.

J. LANE MORTHLAND

1. MID-SPAN TAPS help bring down the over-all cost of distribution with Rome's Triplex SD and secondary cable. You can tap between poles from either side, using conventional hardware plus a spreader block. Simple; fast; saves service wire. You save on pole cost, too—*as much as one-third*. With Rome's Triplex secondary you can span 300 feet from pole to pole. Use fewer poles; save time setting them; eliminate crossarms.

2. SAVE ON HARDWARE. Here's a comparison between the hardware needed to install one open-wire service drop (right)—using one pole—and Rome's aluminum Triplex equivalent (left) using a mid-span tap.

3. CUT MAN-HOURS on installation jobs. Triplex goes up much faster than open-wire service, because it requires less handling, less time installing hardware. It's easier to handle, too—aluminum cable assembly weighs less than conventional copper service wires.

If you take advantage of these important savings . . .

"Expensive" Triplex cables can cost less

Triplex sometimes *does* cost more than its open-wire equivalent.

But its on-line cost can be lower—*if you take advantage of the installation economies* that Triplex alone makes possible.

Fewer poles . . . less hardware . . . faster installation—these are the savings you make with Triplex. They can more than offset any extra cable cost.

In addition, there are many locations where you can improve service and reduce maintenance with Rome's aluminum Triplex. Wooded areas, for example—where Triplex *stays up* despite falling tree branches that might knock out open-wire secondaries. Residential streets, too—where good public relations indicates need for a neat, uncluttered installation.

Fits your modernization pattern

Introduced 10 years ago, Rome's Triplex SD Cable won almost immediate acceptance. As a next step in modernization, many utilities are now using lightweight aluminum Triplex for overhead secondaries as well. If you haven't yet adopted this practice, we invite you to look into the operating advantages—as well as the economies—that this Rome "package" concept offers you.

Specify Rome's aluminum Triplex for your next job. For more information, contact your nearest Rome Cable representative—or write to Department 368 and ask for descriptive Bulletin RCP-361. Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

Stewart Is Advanced

R. F. STEWART

Western Precipitation Corp has advanced R. F. Stewart from sales manager of the Precipitator Sales Division to vice president of the firm.

Stewart's experience during his 11 year association with the company includes posts as sales engineer, assistant chief estimator, and chief contract engineer. He rose to his most recent position in 1955.

Hall Rises to President

New president of Charles T. Main, Inc, consulting engineers, is Wilfred M. Hall. William F. Uhl, president since 1941, is now chairman of the board.

Hall, a vice president since 1953, is also a partner in Uhl, Hall & Rich, engineers for New York State Power Authority.

R. T. Colburn was elected vice president and R. W. Logan treasurer.

W. M. HALL

PERSONAL BRIEFS

Robert G. Schneider has advanced from assistant treasurer of Virginia Electric & Power Co to the new post of comptroller. His former position has been assumed by **Charles R. Goode, Jr.**

Boston Edison Co's **Harold E. Stickle** has been appointed chief engineer of steam stations, production department, to replace **Charles Irving,** retired.

Indianapolis Power & Light Co has elevated **R. H. Goodrich** to the new post of assistant to vice president-production; **H. F. Roempke** to assistant to vice president-operation, also a new post; and **C. B. Vance** to superintendent of power production.

The commercial department of Niagara Mohawk Power Corp has named **John V. Lasher** manager at Schenectady, **Donald S. Creal** manager at Glens Falls, **Henry J. Sneck** manager at Hudson, **Thomas W. Dowling** manager at Canajoharie, and **Ralph P. Van Woert** manager of the Champlain district.

Theodore Hudspeth is new system manager of the right-of-way departments of Jersey Central/New Jersey Power & Light Cos. . . . The two companies have named **Joseph A. Sherry** director of public information to succeed **Sam A. Lafaso,** now manager of advertising and publicity for the American & Foreign Power Company.

Public Service Electric & Gas Co's Southern Division has designated **Charles A. Scherer** division meter engineer in the Trenton electric distribution department.

Curtis Van Hoy succeeds retiring **Milo P. Clark** as Western Division engineer at Public Service Co of Indiana, Inc.

At Consumers Power Co, **William N. McClelland** has been promoted to the new post of purchasing operations supervisor in the purchasing and stores department, general office; **Gerhardt C. Moehlmann** was named distribution operating engineer in the electric distribution department; and **Isaac Pallas** replaced him as general meter superintendent.

Commonwealth Edison Co's **Sidney Westby** has been appointed Joliet district superintendent. He replaces **Vern Hahneman,** now staff assistant in the office of the Southern Division vice president.

Zach S. Teague of Carolina Power & Light Co has been elevated to fuel engineer and is replaced as Goldsboro plant superintendent by **E. J. Pearson.** New superintendent at the Lumberton plant is **W. E. Selkinghaus.**

E. A. Roof was recently named to the newly created position of wiring promotion specialist at Potomac Edison Co.

Pennsylvania Power Co has appointed **George T. Roberts** general appliance sales supervisor; **Walter K. Conover** general supervisor of publicity and sales promotion; and **Lyle B. Bramhall** advertising specialist.

Arkansas-Missouri Power Co's Walnut Ridge district has as its new manager **Joe T. Hughes,** who continues as the company's director of personnel. **Harold T. Boyd** has been named local manager at Walnut Ridge.

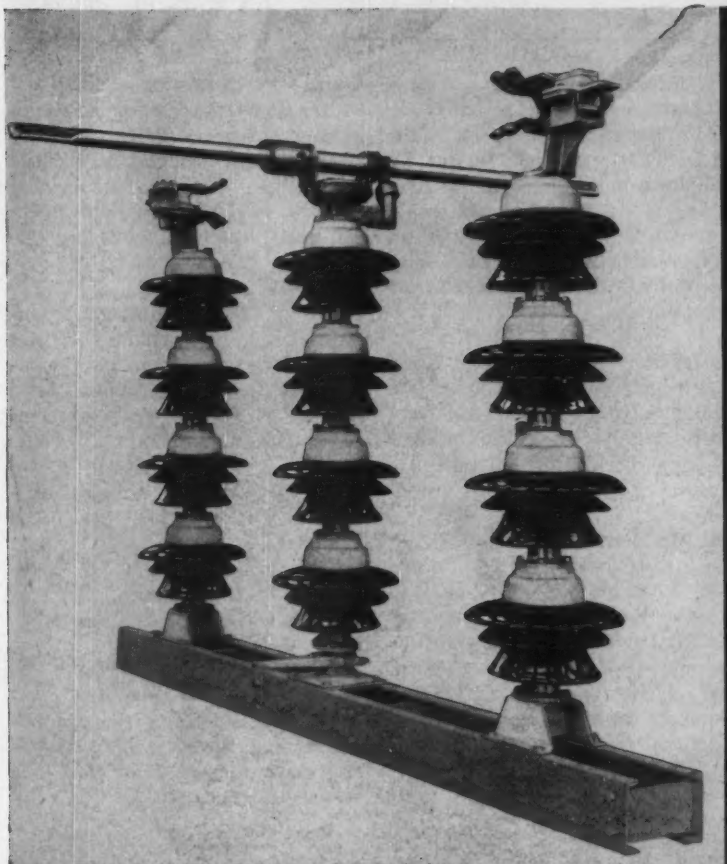
New steam superintendent of Pacific Gas & Electric Co's San Francisco Division is **Neldon E. Rhodes.** He succeeds **Per Albert Person,** retired.

In recent Gulf States Utilities Co promotions, **Lionel V. Dugas** became system supervisor of industrial sales; **Owen G. Floyd** system sales promotion supervisor; **Lamoyne Goodwin,** system supervisor of area development; and **Jack W. Kirkland** operating superintendent of the Navasota Division.

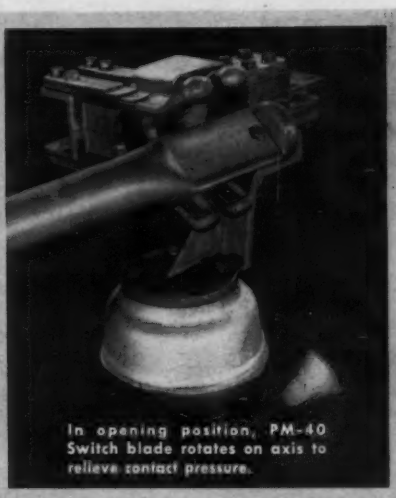
Egbert A. Harris has assumed responsibility for Arkansas Power & Light Co properties in the Bauxite area. **Fred N. Stiers** takes over similar duties in the Lonoke area.

B. C. Power Commission has appointed **P. J. Croft** to replace **S. H. Clarke** as stations engineer.

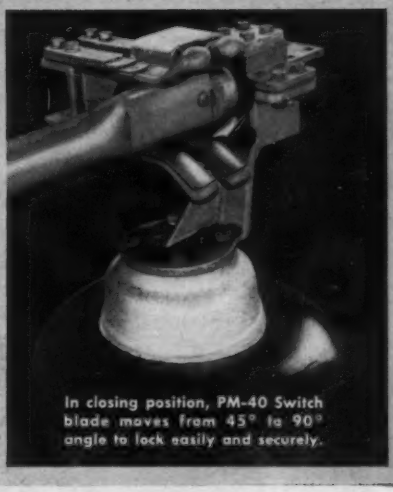
(*Continued on page* 144)



PM-40 Double-Side-Break Switch features easy-rotating blade, high pressure silver-to-copper contacts, factory-sealed insulator bearing, and heavy duty construction. Voltage ratings, 115 to 330 KV; 600 to 1600 amperes.



In opening position, PM-40 Switch blade rotates on axis to relieve contact pressure.



In closing position, PM-40 Switch blade moves from 45° to 90° angle to lock easily and securely.

Here's easy, positive operation with Delta-Star's PM-40 Side-Break Switches

The ease of operating Delta-Star's PM-40 Double-Side-Break starts with its engineered simplicity. The rotating blade operates by over-toggle mechanism on a center rotating insulator. Balanced spring arrangement reduces operating effort when switch is opened or closed.

The simplified blade-actuating mechanism exerts enough power to easily break ice or corrosive formations—assuring ease of operation at all times.

PM-40 contacts are straight-line current path design with no offset to produce stress during fault currents. Tubular switch blade is one-piece, hard-drawn copper, with silver inlay contact points. The blade rotates on a factory-sealed, ball-bearing base.

Where you prefer or require side-break switches in voltage ratings of 115 to 330 KV, the Delta-Star PM-40 definitely deserves first choice consideration.

Call Delta-Star Electric Division,
H. K. Porter Company, Inc., Chicago 12, Illinois.
District offices in all principal cities.

DELTA-STAR ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc.: Connors Steel, Delta-Star Electric, H. K. Porter Company (Canada) Ltd., Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings.

Orion Lorenzi has been appointed secretary of the Lincoln Service Co of Frontier, Wyo. . . . New Jersey Public Utilities Commission has appointed as its new secretary **Richard F. Green.**

R. U. Blaser and **J. J. Owens** received the 27th Charles B. Dudley Medal at the recent American Society for Testing Materials annual meeting. They were recognized for their paper on "Special corrosion study of carbon and low-alloy steels."

J. C. Dale has been elected president of the Canadian Electrical Assn. Dale is president of Canadian Utilities, Ltd. Newly elected executive committee members are **J. E. Babbitt,** Canadian Niagara Power Co, Ltd.; **A. R. Harrington,** Nova Scotia Light & Power Co, Ltd; **A. C. Abbott,** Shawinigan Water & Power Co; and **J. N. Ford,** Canadian Utilities.

In a reorganization of the engineering and construction activities of General Electric Co's real estate and construction operation, **Joseph C. Nowell** was named manager of engineering of the newly created engineering operation and **Samuel T. Whitebread** became manager of construction for the new construction operation.

Olin Mathieson International Corp has elected **Alfred T. Zodda** vice president-operations for all overseas operations of the firm and has appointed **Clement M. Brown, Jr,** as regional vice president-Europe.

Paul M. Hafer was recently made plant manager of Federal Pacific Electric Co.'s Cleveland plant.

The Market Development Division of Enjay Co, Inc, has designated **Dr L. T. Eby** as senior market development engineer for industry information.

W. B. Creech has been appointed to the newly created position of manager of the Appliance Service Division at Westinghouse Electric Corp. . . . The firm has named **Andrew R. Evans** assistant director, real estate and insurance department.

Philco Corp's Government & Industrial Division has named **Herbert E. Taylor, Jr,** as marketing manager for industrial products and **Richard M. Fielding** as manager of public information.

Tobe Deutschmann Corp's Engineering Division has designated **Robert L. Stone** assistant manager. New project engineer at TD's engineering labs in Venice, Calif, is **Jerry B. Eicher.**

At The Bristol Co, **Walter E. Rufleth** has been appointed manager of telemetering systems applications and **Kenneth R. Neale** has been named manager of electronic products applications.

Radio Corp of America's recently reorganized Electron Tube Division has appointed **L. F. Holleran** as manager of the new distributor products component and **C. E. Burnett** as manager of the new industrial tube products unit.

Plaque Honors Fairchild

Dr Frederick P. Fairchild, (right) chief engineer of Public Service Electric & Gas Co's electric engineering department, has been honored for his leadership as the first to use austenitic steel in high temperature, high pressure power plant piping.

The plaque honoring his achievement was presented by Norman L. Mochel (left) of Westinghouse, and by A. W. Rankin of General Electric Co and Waldo McKee of the M. W. Kellogg Co.

OBITUARY

Earl J. Dyess, 52, vice president of the Southwestern Gas & Electric Co, died recently in a Fayetteville hospital.

Edward J. Good, 48, vice president in charge of sales of Louisville Gas & Electric Co, died suddenly following a cerebral hemorrhage.

Dr Harry Stanley Rogers, 66, fifth president of Polytechnic Institute of Brooklyn, died after a cerebral hemorrhage. He had been president since 1933.

John M. Whouley, 61, member of the Massachusetts Department of Public Utilities since 1938 and former chairman, died recently.

We switched to Penta-treated poles because the records prove they're better

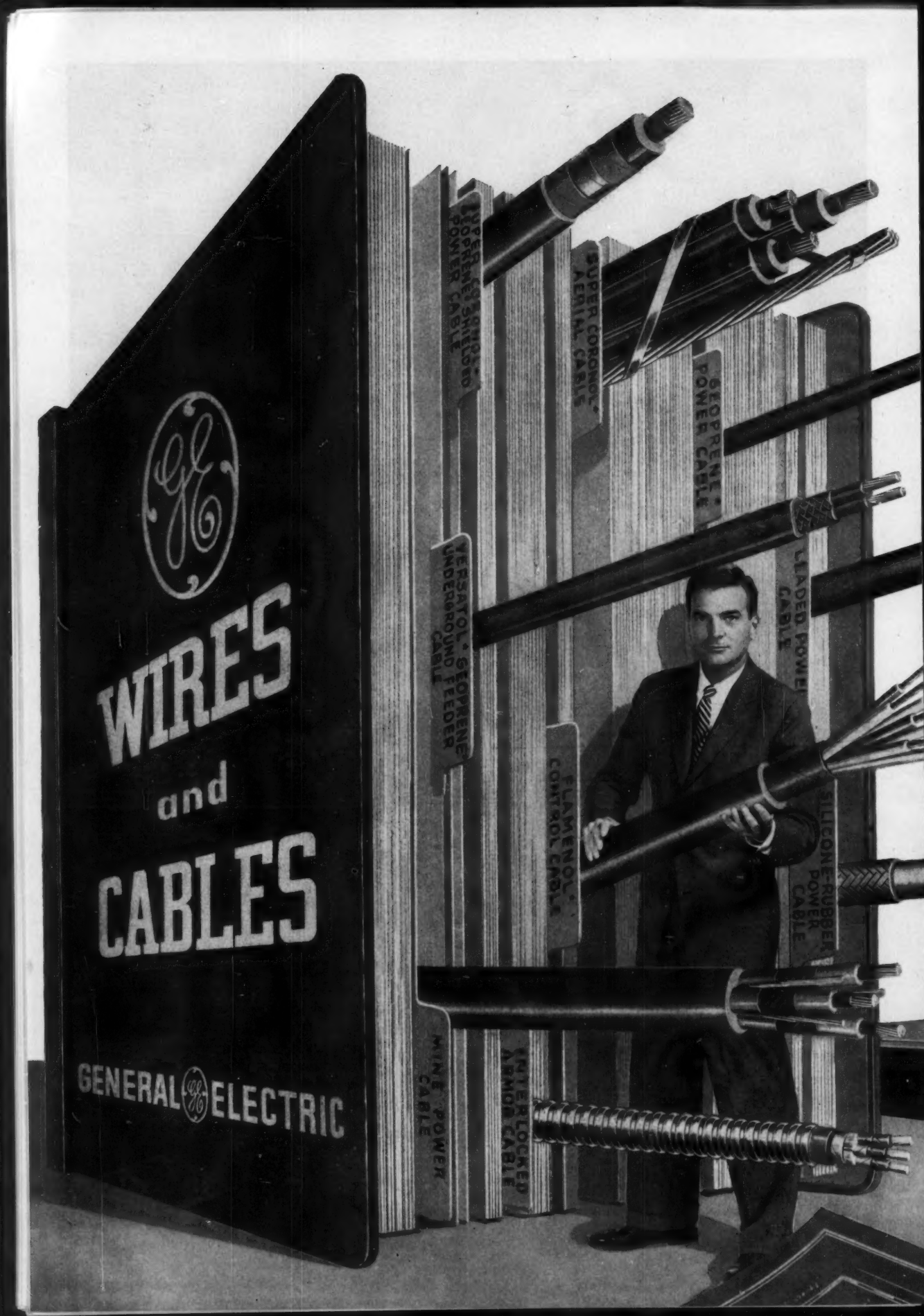
Ran into Ernie—he's division maintenance super—in the pole yard yesterday. He asked how things were going in purchasing, so I told him that among other things the new specs had come through and we'd been busy changing our purchase orders to Penta-treated poles and crossarms.

Right away Ernie started telling me all over again why he'd recommended the switch—that Penta-treated poles are cleaner and easier to handle. He reminded me that U.S. Government tests and service records of other utilities prove that Penta keeps rot and termites out of poles and gives them a longer service life. And he mentioned that many other utility companies are switching to Penta, too.

After he got all through, I assured him that specifying Penta caused no special problems in purchasing because Penta-treated poles and arms cost no more than those treated with old-fashioned preservatives.

THE DOW CHEMICAL COMPANY, Midland, Michigan, Department PE 502B.

YOU CAN DEPEND ON DOW


WIRES
and
CABLES
GENERAL ELECTRIC
SUPER CORONOL AERIAL CABLE
GEOPRENE POWER CABLE
LEADED POWER CABLE
VERSATOL GEOPRENE UNDERGROUND FEEDER CABLE
FLAMENOL CONTROL CABLE
SILICONE-RUBBER POWER CABLE
MINE POWER CABLE
INTERLOCKED ARMOR CABLE

catalogs full of cables... but

which one is right for your job?

The problem of selection is one of the important reasons why many electric utilities and industrial plants work with General Electric wire and cable engineers in planning their electrical expansion and modernization programs.

Today, selection of the best wires and cables for your particular needs calls for consideration of a wide variety of factors ranging from standard requirements such as flame-, heat-, moisture-, and weather-resistance—to special constructions which withstand vibration, the electromagnetic effects of adjacent power cables—even the effects of atomic radiation.

General Electric's knowledge of the requirements of other basic components of power distribution systems—transformers, load centers, switchgear, etc.—has led to the conviction that the right cable plays an important part in satisfactory system performance.

As a result, General Electric has developed hundreds of cables for just about every possible application. Thus, G-E engineers are not limited to one wire or cable for a given job but can suggest the most efficient and economical solution for the particular situation.

All this adds up to experience that can benefit you. Take advantage of it the next time you have a cable selection problem. For information on your specific wire and cable application or selection problem, see the G-E wire and cable specialist in your locality or write Section W201-727, Wire and Cable Department, General Electric Company, Bridgeport 2, Connecticut.

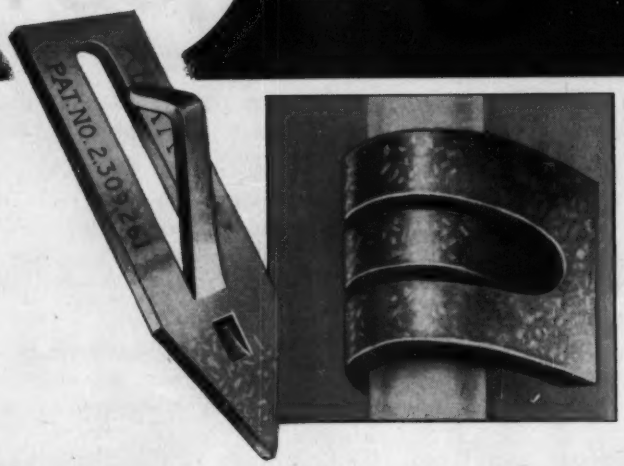
*Registered Trade-mark General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC

eliminates radio interference

KEARNEY NON-STATIC GROUND WIRE CLIP



When ordinary staples lose their hold in wood, contact pressure drops, and resultant air-gap static causes radio and television interference. KEARNEY Non-Static Ground Wire Clips prevent this interference by maintaining permanent, high pressure contact with ground wires, entirely independent of how tightly the clip is set in the pole.

When this clip is driven, a hook automatically, permanently grips the wire, remaining free of all trouble-causing air gaps. Inexpensive and easy to drive, this clip holds fast in all woods.

Easy to install: Just drive clip until point seats firmly in wood. Insert ground wire under hook, then drive until hook grips wire and starts protruding through slot in body. Bend end of clip over the wire and into the wood.

-358

JAMES R. KEARNEY CORPORATION • General Offices: 4224-42 Clayton Ave., St. Louis 10, Mo.

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify **KEARNEY PRODUCTS**

Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. — GUELPH, ONT., CAN.

READERS FORUM

Another Editor Agrees

To the Editor:

Reaching my desk last week was "the second collection of case histories" of Live Better . . . Electrically. It is an excellent production distributed by Bill Troy who, incidentally, is doing a wonderful job for Live Better . . . Electrically.

However, I had a sort of feeling that something was out of place. The constant abbreviation of Live Better . . . Electrically to merely LBE seemed almost out of character, somehow.

I couldn't quite put my finger on the discordant note until I ran across a recent editorial in Electrical World. The editorial, I can't resist adding, concluded that Live Better (Farm Better) . . . Electrically is a fine thing and shouldn't be abbreviated. Hence, I have instructed my staff that we will not tolerate LBE's or FBE's.

William S. Roberts
Editor
Rural Electrification Magazine
2000 Florida Ave, NW
Washington 9, D. C.

Trends in Planning

(*Continued from page* 80)

For a primary distribution feeder outage of long duration, 45 compaines always or sometimes split and transfer the load to several other feeders. An unloaded feeder to carry the load of any faulted one in the area is provided by five companies, two providing the feeder for underground cable only.

Maximum allowable feeder outage time is about the same whether the feeder serves many small loads or one or two large ones. Most companies allow from 30 to 240 min, about 100 min the average duration. But only up to 5 min is allowed by one company for many small loads on a feeder and by two companies for one or two large loads on a feeder. For a single feeder outage, a maximum loss of load up to 2.5 Mva is accepted by seven companies, 2.6 to 5 Mva by ten companies, and over 5 Mva by six companies.

For both present and future standards, the maximum number of circuits per pole line ranges from one to over five, two the prevailing maximum. Use of one overhead feeder to provide reserve a capacity for a second feeder on the same pole line is planned by 18 of 43 companies.

Almost all companies use or contemplate primary voltages in the 11 to 15-kv range to supply 120/208-v networks. Some compaines contemplate more than one primary voltage. Of these other primary voltages, 4 to 5 kv is used or planned by 18, and 22 to 27 kv by ten. Maximum load planned for a network area generally lies between 31 and 40 Mva. As the number of feeders supplying a network increases, the trend is to plan on the basis of loss of two feeders without loss of load. But 17 companies having 6 to 9 feeders to a network still plan on the basis of losing only one feeder.

The prevalent range for the maximum single 120/208-v load supplied from one vault is under 1.5 Mva, with eight companies within a range of 1.5 to 3 Mva, and two within 3 to 4 Mva. Spot networks at a voltage higher than 120/208 v are provided by 18 of 41 compaines, with 460 to 480 v predominating. Service to large loads in the network area is planned at other than network voltage by 26 of 40 companies.

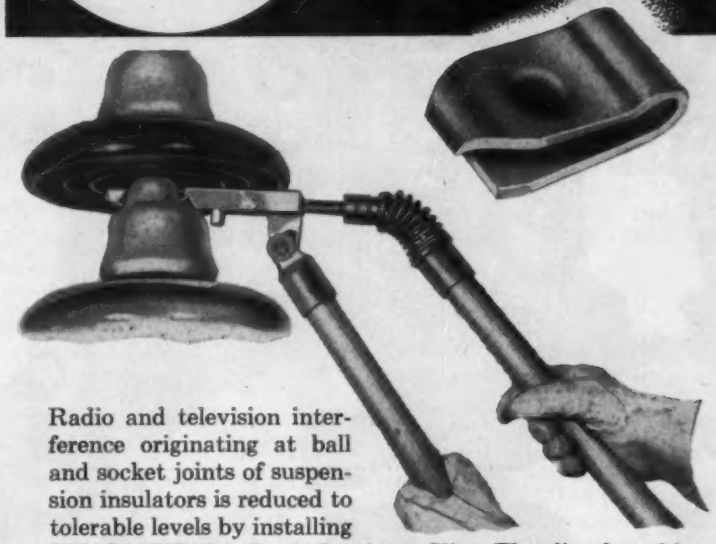
Primary network connection of distribution feeders is the present standard of ten companies and the future standard of 12. In both present and future standards, the preference for 4 kv over 11 to 13.8 kv as the feeder voltage is about two to one.

In planning distribution feeders for industrial customers not supplied from a low-voltage network, 24 companies normally provide reserve primary feeder capacity for critical loads only. Reserve capacity is provided at the customer's expense only, or not at all by 14 companies.

Among five companies, minimum loads for which reserve feeder capacity normally will be provided range from 125 to 2,000 kva with manual transfer equipment and for minimum loads of from 1,000 to 5,000 kva with automatic transfer equipment.

easily installed on hot lines

KEARNEY NON-STATIC INSULATOR CLIP and installing tool



Radio and television interference originating at ball and socket joints of suspension insulators is reduced to tolerable levels by installing KEARNEY Non-Static Insulator Clips. The clips force high pressure contact between large areas of metal of the ball and insulator cap, thus preventing static discharges otherwise caused by overstressing air insulation between the metal parts.

Effective in any position of insulator string from vertical to horizontal, they lock in place, will not fall out. Easily installed on hot lines without disassembling insulator string. Made of heavy spring steel and corrosion protected.

Installing the clips is a simple one-man job with this KEARNEY Installing Tool that fits all insulators; operates at all angles. Thumb pressure loads clip into throat of tool. Suitable for hot line work, the tool is self-positioning on the insulator cap, forces clip into position by screw pressure.

-361

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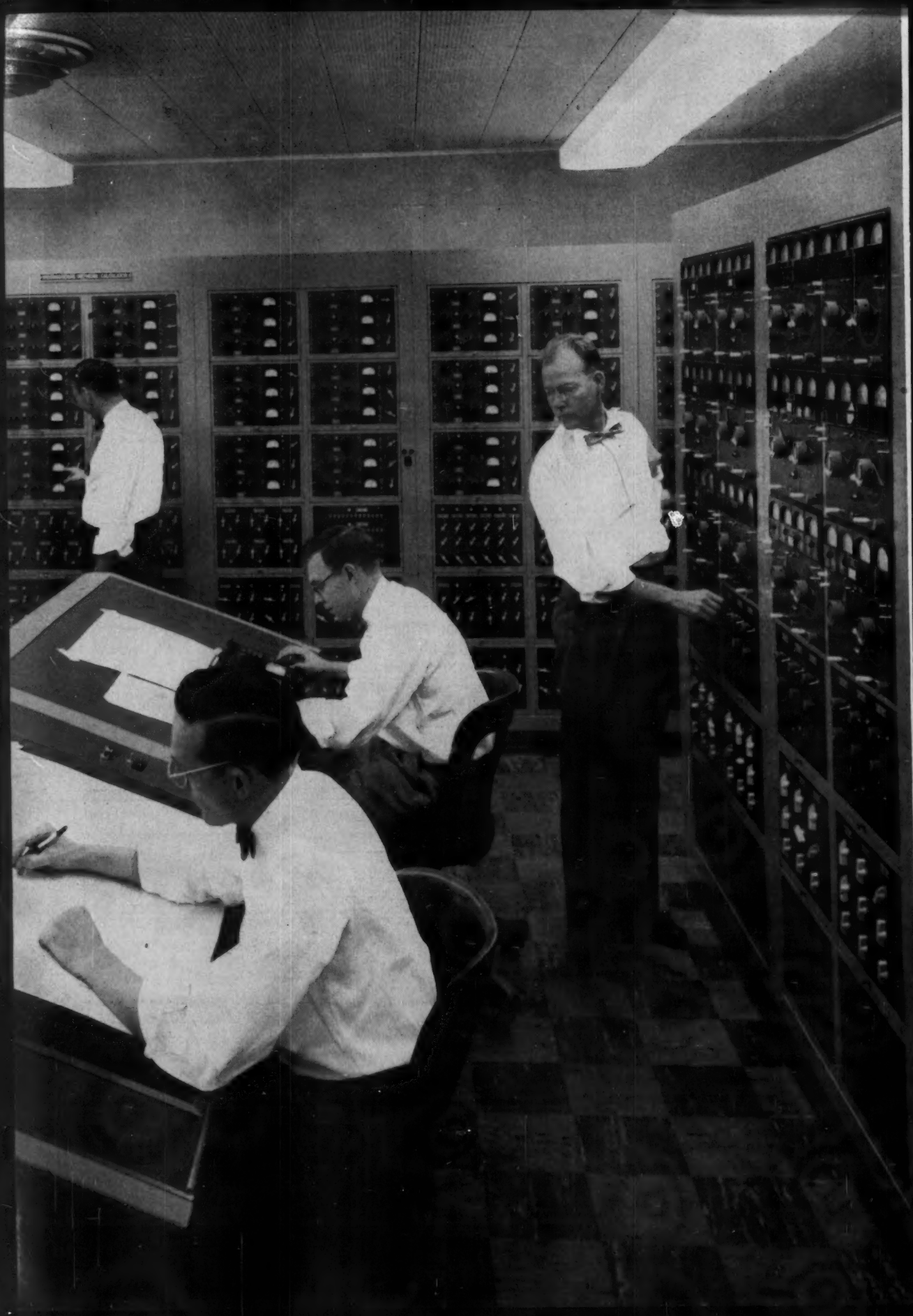

Helping the Industry meet its growing loads

The creative abilities of 750 engineers unshackled each year

Each year, Westinghouse "machines that think" have been taking over more and more tasks that steal an engineer's time. Performing calculations in less than 1% of the time required by the engineer, these machines give him more freedom for creative planning.

This year, again, computer facilities in the Analytical Department at the Westinghouse East Pittsburgh works are saving utilities over a million and a half hours in engineering time . . . unshackling for a year the equivalent of 750 engineers.

These extraordinary facilities—developed by Westinghouse—are doing tomorrow's planning today . . . planning power transmission systems far into the future, solving the complex problems of automated power plant operation. Computer studies solve problems which, because of the time factor involved, have never before been economically practical for thorough study.

These modern research tools will save weeks, months, even years, over the time it would take to solve your system problems by ordinary means . . . another example of Westinghouse leadership in helping the utility industry meet America's growing electrical load—faster and more economically.

J-97210

YOU CAN BE SURE...IF IT'S

Westinghouse

'HIDDEN' EQUIPMENT—There's a five-state power network in this picture, complete with generating stations, power lines, homes and factories. When this picture was taken, the calculator was "answering" questions about a future power network. Seated at instrument desks, W. E. Furniss (left) takes down "answers" read by L. J. Rindt. R. W. Smith, West Penn Power Company engineer, looks on. In the background, R. H. Swanberg, Chief Operator of the calculator.

A-C Network Calculator

Foremost among the machines serving the utility industry at the East Pittsburgh works is the world's largest a-c network calculator, with 36 generating stations and 580 circuits. This electronic marvel simulates every part of an actual power system—transformers, generators, transmission lines and loads—and is used in studies of very large systems.

Ranking high in importance of the studies performed on the a-c calculator are those of power system planning. In general, these fall into three classes:

1. *Load division or voltage regulation studies*—generator power factors, location of system components for best over-all results, system losses, location of new system components.

2. *Transient stability studies*—power limit of lines or portions of a network, optimum switching time for faults, effect of various bus arrangements.

3. *Short-circuit studies*—breaker duty, effect of different methods of grounding, both phase and ground short-circuit currents, mutual coupling and ground current—inductive coordination.

Other Computers

Other Westinghouse aids to economic power generation and distribution include digital computers, analog computers, electronic differential analyzers, and the d-c calculating board. The Analytical Department is fully staffed with men thoroughly experienced in programming information for virtually every type of study which can be made with these machines.

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Advertising in This Issue

Aerotec Corporation 116
Allis-Chalmers Mfg. Co. ...4th Cover
8, 9, 29, 43, 108, 109
Aluminum Co. of America. 28, 132, 133
American Blower Div., American-Standard 104, 105
American Brass Co. 34
American Chain & Cable, Wright Hoist Div. 127
American Creosoting Corp. 32
Anaconda Wire & Cable Co. ..44, 45
Anchor Mfg. Co. 121

Baltimore & Ohio Railroad 41
Bartlett Mfg. Co. 126
Bethlehem Steel Co. 154
Blackburn Corp., Jasper 42
Brown Company 110
Buffalo Forge Co. 96, 97

Coates Field Service, Inc. 127
Combustion Engineering Inc. .30, 31
Cope Div., Rome Cable Corp. ... 114
Crescent Tool Co. 46

Delta-Star Electric Division, H. K. Porter Company, Inc. ... 143
Directory of Engineers 152
Dow Chemical Co. 145
du Pont de Nemours & Co., Elastomer Chemicals Dept. ... 107

Edmund Scientific Co. 127
Elliott Company 11
Engineers, Directory of 152

Fanner Mfg. Co. 118
Foster Wheeler Corp. 12, 13

G&W Electric Specialty Co. 139
General Electric Co.,
Apparatus Dept. ...2nd Cover, 6
35, 81, 82, 84, 85, 87, 117
Large Lamp Dept. 134
Wire & Cable Dept. 146, 147
Gould-National Batteries, Inc. .. 111
Graybar Electric Co., Inc. 7

I-T-E Circuit Breaker Co., Switchgear Div. 119
Indiana Steel & Wire Co., Inc. .. 98
Ingersoll-Rand 55

Kearney Corp., James R. 148, 149
Kuhlman Electric Co. .....3rd Cover

Lapp Insulator Co., Inc. 16, 17
Leeds & Northrup Co. 38, 120
Line Material Industries 23, 24
25, 26, 27

Meter Devices Co. 127
Minneapolis-Honeywell Regulator Co., Industrial Div. 99
100, 101, 102
Minnesota Mining & Mfg. Co. ... 36
Moloney Electric Co. 56
Murray Mfg. Corp. 51

Ohio Brass Co. 10, 39, 40
Okonite Co., The 4

Pacific Coast Engineering Co. ... 115
Pennsylvania Transformer Div., McGraw-Edison Co. 14, 15
Petersen Engineering Co. 88, 89
Phelps Dodge Copper Products Corp. 92, 93
Porcelain Products, Inc. 52

RT&E Corp. 33
Reynolds Metals Co. 122, 123
Roebling's Sons Corp., John A. 112, 113
Rome Cable Corp. 141

S&C Electric Co. 18
Sangamo Electric Co. 128, 129
Searchlight Section 152
Standard Transformer Co. 37
Superior Electric Co. 125

United States Steel Corp. 53

Wagner Electric Corp. 131
Westinghouse Electric Corp. 47
48, 49, 50, 54, 95, 150, 151
Wright Hoist Div. American Chain & Cable 127

■

PROFESSIONAL SERVICES 152

■

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES ... 152

EQUIPMENT
(Used or Surplus New)
For Sale 152

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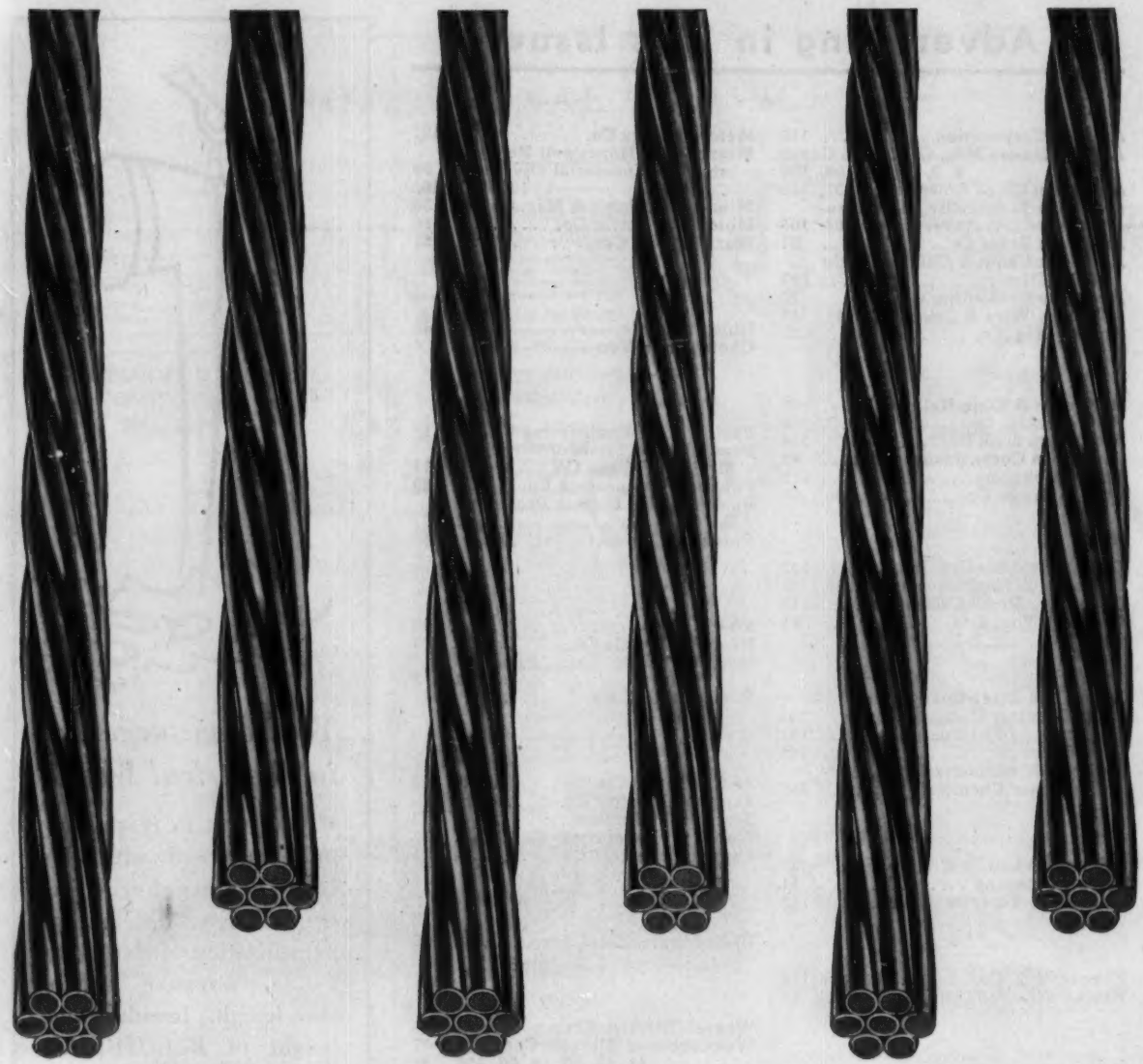

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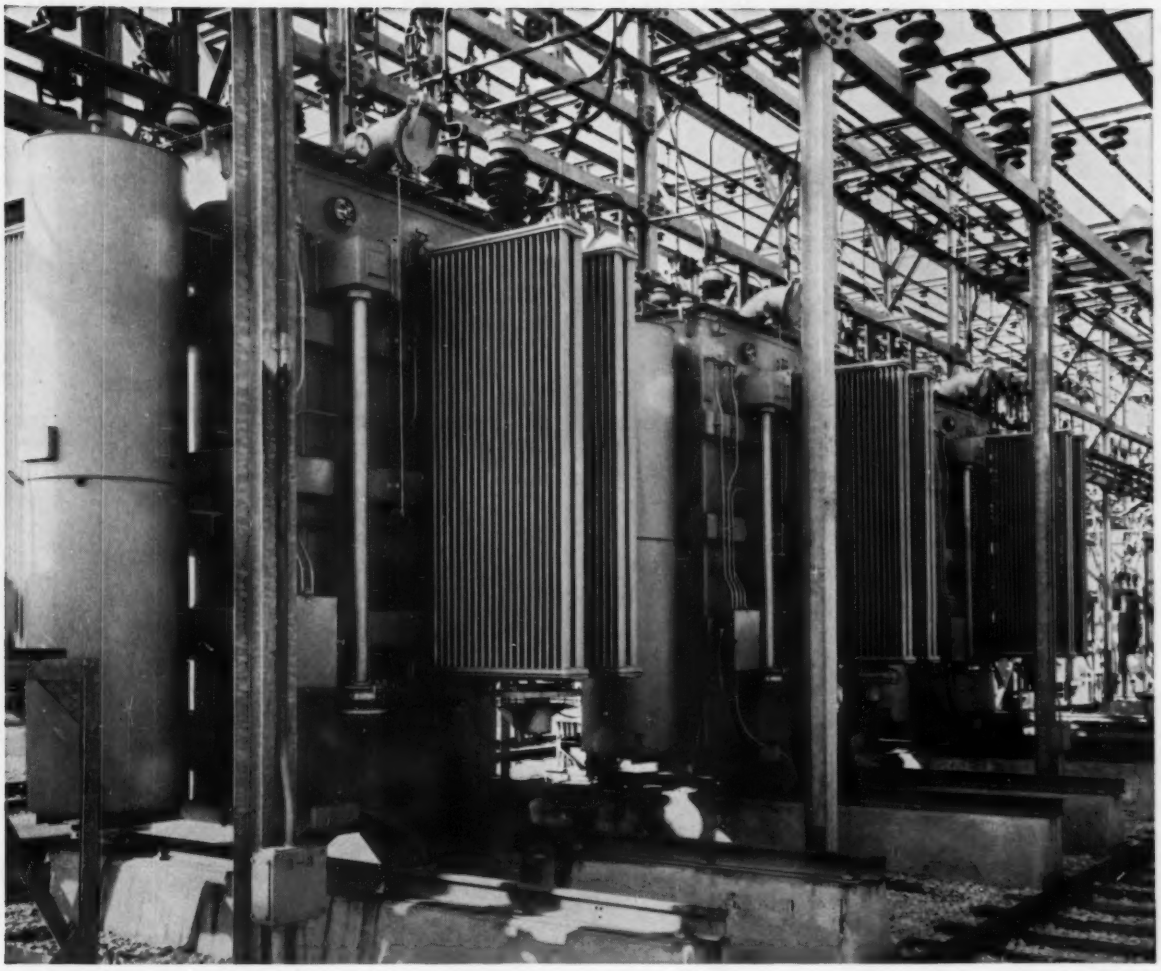

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